

Left: The Mint to Right: 1779

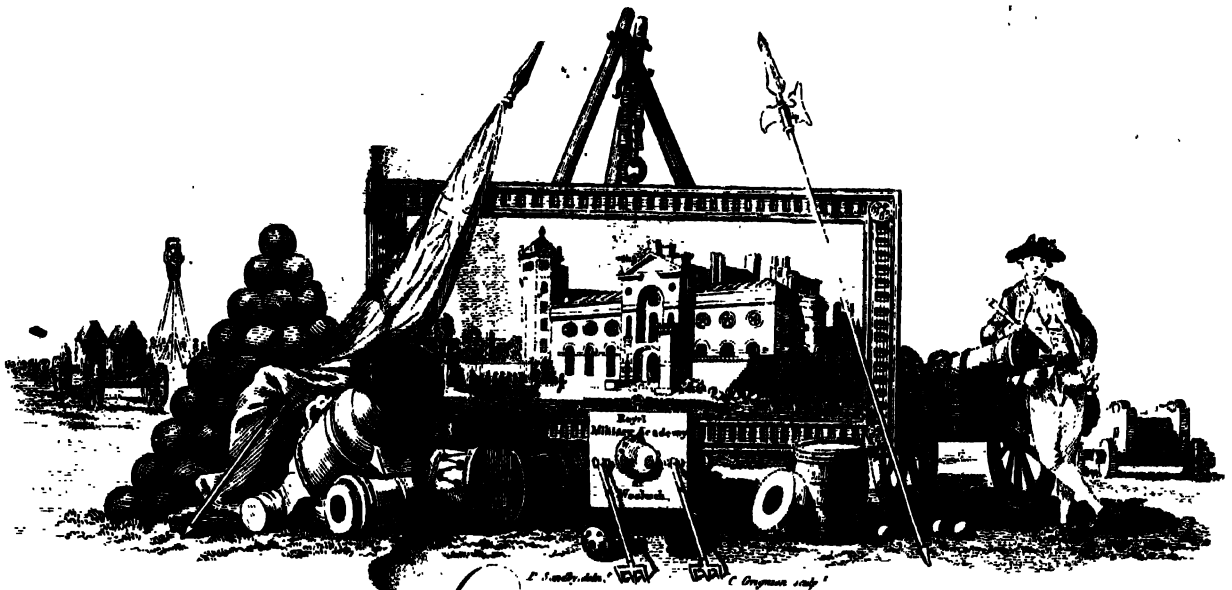
AN
Universal Military Dictionary,

A Copious Explanation of the Technical Terms &c
Used in the Equipments, Machinery, Movements,
(and Military Operations of an Army.

By

CARL GEORGE SMITH,

Inspector of the Royal Military Academy at Woolwich.



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T O T H E
K I N G.

S I R E,

NOTHING can justify my presumption in approaching your Royal Person with this Work, but the consideration, that it is not foreign to the station in which your Majesty has vouchsafed to place me, and that it treats of an Art which constitutes one of your favorite amusements.

Animated

Animated with the desire of promoting, within my own sphere, the interest and welfare of my Country, I have been emboldened to engage in the undertaking: And, persuaded that your permission to address my Work to your Majesty cannot fail to suggest to every Student in the Military Art, that such a performance is essential to the attainment of that Art, I have cherished the ambition of laying it at your Royal feet; hoping, that under the gracious favor and protection which your Majesty deigns to extend to the well-meant endeavours of your Subjects, it will be conducive to the end for which it was undertaken.

That your Majesty may long reign in the hearts of a brave, free, united, and happy People, is the ardent wish of

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P R E F A C E.

IT being the general opinion, that the dignity of sciences is more or less in proportion to their usefulness, how apparently then does the Art of War claim the first place! War (as some say) is a great evil; but it is inevitable, and oftentimes necessary. If he who first reduced to rules the art of destroying his fellow-creatures, had no other end in view but to gratify the passions of Princes, he was a monster, whom it would have been happy to have smothered at his birth! but if his intention was the defence of persecuted Virtue, or the punishment of successful wickedness, to curb Ambition, or to oppose the unjust claims of superior Power, his memory should be revered by mankind.

War, in the last case, is the most necessary and useful of all the sciences. The various kinds of knowledge, which should furnish the mind of a Soldier, are not without great difficulty attained. Of most other sciences the principles are fixed; or, at least, they may be ascertained by the assistance of experience: there needs nothing but diligence to learn them, or a particular turn of mind to practise them. Philosophy, Mathematics, Architecture, and many others, are all founded upon invariable combinations. Every man, even of a narrow understanding, may remember rules, apply them properly, and sometimes draw just consequences from them: but the study of War is of another kind.

Experience can be so seldom referred to rules, that nothing but a mind enlightened by diligent study can make a due application of those rules to circumstances.

Most artists may join practice to theory, and make one perfect by the help of the other. The military man has not always the like assistance: he spends part of his life in forming plans, which humanity forbids his putting in execution; and when he has an opportunity of judging from experience of the solidity of his principles, the operations are so rapid, the motions so diversified, the actions so confused, that he has scarcely time for a glimpse of those things which require the most calm and close consideration.

Of learning of every kind, theory is the completion; in the study of the military science, it is only the introduction. Many an Officer, depending on his rules, has found that the marches, the camps, the dispositions, the manœuvres, performed with exactness and strict order in the closet, have not only been very difficult, but even impracticable, in the field. A disposition good in a mountainous country, would be bad in an open one; a disposition proper for one open country may fail in another, for want of its being foreseen that a manœuvre, which in one case may have been the cause of obtaining a victory, may in another occasion its loss: the circumstances of time and place almost always throw the best-constructed systems out of order. It is therefore only by study, and by the contemplation of cases incessantly varied, that the want of practice can be supplied, or action at least made less difficult.

A military man, who wishes to be master of his profession, has no hours to lose: in peace he should study with the greatest diligence; in war he will see his principles
open

open themselves of their own accord: his ideas are then more distinct; he acts with clearness and certainty in all cases he has foreseen, and applies his rules to all those which now occur for the first time, and which 'till then had escaped his attention. Who does not know that bravery, courage, and comprehension, are useless and fatal to a military man who wants knowledge of his business? Having no previous assistance from study, it often happens, that the braver he is, the more he is liable to mistakes, and the less able to foresee or avoid them.

The science of War branches out into so many particulars, it takes in so many different parts, there are so many reflections necessary to be made, so many circumstances and cases to be brought together, that it is only by a continual application, grounded upon the love of his duty, and an inclination to his profession, that any man can attain it.

To march an army in every sort of country, whether open, woody, or mountainous; to know how to form a camp in all these countries, with which the General must be thoroughly acquainted, in order to do it securely; to make a proper disposition for a battle, whether with a view to the posture of the enemy, or to the situation of the country; to foresee events which depend, in a manner, upon chance; to direct the foragers without fatiguing, or exposing the troops; to send out detachments with precaution; to conduct the convoys with safety; to know how to canton an army, and to settle it in winter quarters, in such a manner, that by the just disposition of all the parts, it may be able to assemble readily on the first order, though widely dispersed; to establish magazines in places both safe and within reach of the army, so that it shall never be in want of subsistence: these are the great ends of the military science. Alexander, Gustavus, Weimar, Condé, Turenne, Montecuculi, Vendôme, Marlborough, Eugene, Schwerin, Wolfe, and all the great men that have gone before, would never have been the subject of our admiration, if they had neglected this study in any of its branches. It is by courage, genius, and capacity; by having a head always cool, and an eye at once quick and exact; by a nice knowledge of the country, by skill in the choice of officers, and by strict discipline kept up in his army, that a General is enabled to take such just measures as will frustrate the designs of the enemy.

It is commonly thought sufficient for a military man to know how to obey; and it is also supposed that the success of a day cannot be dubious, if a General joins the confidence of the Soldiers to all the foregoing qualities.

It is true, that in cases of perplexity, many Generals have in a great measure owed to their own capacity, and the confidence their Soldiers have reposed in them, the advantage they have gained over the enemy. But is the Officer who loves his duty, and who would make himself master of it, under the less obligation to know what qualifications his station requires? that he should have such or such a quality, in such or such a circumstance? that here only bravery is necessary, there only courage? and that he is not always obliged to have both at the same time?

These two virtues, which are often confounded in the same subject, merit a particular distinction: they are not so closely united, but that they are often to be found one without the other. Courage seems fittest for a General, and all those who command; bravery more necessary for a Soldier, and all who receive orders: bravery is in the blood, courage in the soul; the first is a kind of instinct, the second a virtue; the one is an impulse almost mechanical, the other a noble and sublime conception. A man is brave at a particular time, and according to circumstances; he has courage at all times, and upon all occasions. Bravery is so much the more impetuous as it is less the result of reflection; courage, the more it is the effect of reason, becomes more in-
 arpid. Bravery is inspired by the force of example, insensible of danger, and the fury
 of

of action; **courage** is infused by the love of our duty, the desire of glory, and zeal for our king and country: courage depends on reason; but bravery, on the constitution. Achilles, such as Horace describes him from Homer, implacable, cruel, despising every other right but that of force, presents nothing to the idea, but the hardness of a gladiator: **but** the Roman General, whose death would have produced the ruin of the army, the great Scipio, when covered by the bucklers of three soldiers, to avoid a shower of arrows which the enemy directed against him, approaches in safety the walls he besieged, and standing only a spectator of the action, and content himself with giving them orders, exhibits the idea of true courage. Bravery is involuntary, and depends not at all upon ourselves; whereas courage (as Seneca observes) may be taught and acquired by education: but yet, nature must sow the first seeds of it. It would be easy to make the difference of these qualities better understood, by running over all the cases in which they make their appearance, were it not for the fear of going too far in so copious a subject. **It is said of** a magistrate, who exposes his life and fortune in defence of the laws, that **he has virtue**. Cicero, sheltering himself from the hatred of Catiline, undoubtedly wanted bravery; but certainly he had an elevated firmness of mind (which is in reality courage), when he disclosed the conspiracy of that traitor to the Senate, and pointed out all his accomplices; or when he pleaded for Deiotarus against Cæsar, his friend and his judge.

Coolness is the effect of courage, which knows its danger, but makes no other use of that knowledge, than to give directions with greater certainty: courage is always master of itself, provided against all accidents, and regulated by the present occasions; never confounded by any danger, so as to lose sight of the motions of the enemy, or of the means by which he may be most effectually opposed. At the battle of Cannæ, when Gisco seemed to be most astonished at the superiority of the enemy's number, Hannibal answered him coolly, "There is a thing still more surprising, of which you seem to take no notice." Gisco asked him what it was: "It is, replied Hannibal, that in all that great croud, there is not one man whose name is Gisco." Plutarch observes, that this coolness of Hannibal greatly animated the Carthaginians, who could not imagine that their General would joke at so important a time, without being certain of overcoming his enemies.

Although bravery and courage are the most essential qualifications of a subordinate officer, yet he should not be deficient in those which are required in a General, and which have been already mentioned: obedience to the orders delivered to him, is no longer a virtue than whilst he comprehends and knows the intention of them. War, says a celebrated author, is a business which like all others must be learned; it supposes some qualities to be born with us, and demands others which are to be acquired: but since all these qualities must have their original source in genius, a man who proposes war for his profession, should never engage in it without having consulted his natural bent, or without knowing the particular turn or power of his mind. Ability, whether in a General, or inferior officer, is the effect of his genius, quickened by a natural liking to his business. Without this liking, without this sort of call, which as it were draws us on against our wills, and which is the sure sign of a particular determination of the mind, a man studies without effect, and practises without judgement.

Genius is not to be acquired; it is born with us. It has been defined to be a natural aptitude of doing something: but that definition is wrong; it is the disposition only that should be so defined. **It is said to be easier** for nature to produce a monster, than a man without a particular disposition: but every one is not born with a genius; it is the fairest attribute of the soul. With parts a man may be a good soldier; but with genius a good soldier becomes a great general. It is sometimes an assemblage of talents, but

but is always the perfection of that which nature has given us, that discovers genius. A man studies ; he searches for his talent, and often misses it ; genius unfolds it. Talent remains hidden for want of occasions to show itself ; Genius breaks through all obstacles : Genius alone is the contriver ; Talent, only the workman.

It often happens, that he who has only bright parts, is believed to have genius. These two modifications of the soul are very different. Genius can only apply itself to the sciences and noble arts ; Wit, more airy, skims indifferently over all : the former undertakes but one science, but goes to the bottom of it ; the other would undertake every thing, but touches only lightly upon all : Wit renders the talents more brilliant, without their becoming more solid ; Genius, with less application, conceives every thing, outstrips even study itself, and brings the talents to perfection.

There are many amongst us who become soldiers, only because their ancestors were so : they undoubtedly have bravery ; that virtue is not scarce among the English ; but there are many others which should accompany it. The virtues of our ancestors should stimulate our minds, and engage us to follow their steps ; but their blood, transmitted to us, does not always convey that sagacity, that intelligence, that particular inclination for our business (the true mark of genius) in a word, those talents of which we must carry the seed within us.

But some are by birth engaged in the profession of arms, before time has permitted them to consult their genius and their powers. Are these men to quit, if they perceive that they are not endowed with every talent that profession requires ? Undoubtedly no ; because they may acquire them. Study and application will in a great measure supply the defects of genius ; docility may serve instead of talents ; the love of glory be equivalent to a liking for their business ; and the virtues of their fathers should always be present to their thoughts. When a man has no ancestors to imitate, he is (if I may use the expression) at liberty to raise a reputation of more or less lustre : by being descended from celebrated ancestors, he is obliged to follow their example, and may often improve upon their virtues. Claudius reproached Cicero with being the first of his race. ‘ But you,’ answered Cicero, ‘ are the last of yours.’ An illustrious descent is oftentimes a burthen : if it adds splendor to the man of virtue, it always disgraces him who knows not how to support it.

A quick eye is natural in some, and in them it is the effect of genius ; others acquire it by study or experience. He who knows how to command himself, and has courage enough to keep himself cool on the most urgent occasions, has the readiest and quickest eye. A quick, hot-headed man, however brave, sees nothing ; or, if he does, it is confusedly, and generally too late. It is this quick eye which enables him to judge of an advantageous post, of a manœuvre to be made, and of a good disposition for the troops, whether with respect to that of the enemy, or to the situation or nature of the country. There is a quickness of eye which depends upon the enemy, and another independent of him. It depends upon the enemy when he has made such a disposition, that to attack him another must be made upon the spot, which renders his defective and weak in some part ; or when, being advantageously posted, the General obliges him to change his position, by making him fearful of being taken in flank, or of being surrounded ; or when it is so contrived as to render the troops on the right useless, by attacking the left, without their being able to assist it.

It is independent of the enemy, when a commander, being at a distance, knows how to take an advantageous position, and how to chuse a camp strong by situation ; when he sees at once what distances there are upon the right and left of the troops, that may prevent either their being molested or surrounded, and observes the posts necessary to be occupied for their safety ; when he marches with a detachment, and diligently surveys the

the ground by which he may retreat, if he should be attacked and repulsed by superior forces, taking care that he may not be surrounded, and that the enemy may not be able to oppose to him a front more extensive than his own.

The quick eye is no other than that penetrating genius, which lets nothing escape it; that looks into the heart, and discovers the lightest impressions which can disorder it. A General who knows how to unite this quality with perpetual coolness, never is in want of expedients; he will see how these events, which to any other would be the presage of his own defeat, may end in the overthrow of his enemies.

The army of Cyrus, in the presence of that of Cræsus, at Timbrea, took a clap of thunder for a bad omen. This impression did not escape the quick eye of Cyrus; but the coolness which on this occasion he knew how to preserve, suggested to him an interpretation which removed his soldiers fears. "My friends, cried he, Heaven declares for us: come on! I hear the sound of victory. Great Jupiter, we follow thee!"

The choice of the general officers depends upon this genius, which discovers every thing: they should be the right-hand of the General in Chief, and as capable of commanding the army as himself.

Whatever good dispositions a General may make, they must prove ineffectual, if not seconded by the general officers under his command; he cannot be every where, neither can he foresee all exigencies that may arise. He is obliged to give only general orders: it is therefore the business of those who command under him, to know how to take the advantage of a wrong movement of the enemy; to take upon them to attack or sustain the troops which are engaged, and, as circumstances vary, to make them advance towards the enemy, either to keep him back, or to attack him. But still we must except the reserve, which should never march without an order from the Commander in Chief.

But the qualities already mentioned would be useless, if order and discipline were not severely observed: the most numerous and best composed army would soon become little else than a body of rangers, who, being only united by the hope of booty, would separate as soon as that motive ceased, and trusting each to his own head, or indulging his own humour, would be cut in pieces party after party: so that, if the General does not keep up subordination (the soul and strength of discipline) his army will be nothing more than a troop of Tartars, acting more from the hope of plunder, than the desire of glory. What art, and what genius, is there not requisite to maintain this subordination? Too much severity disgusts the soldier and renders him mutinous, discourages him, and makes him desert; too much indulgence sinks him into indolence, and makes him neglect his duty: licentiousness causes that subordination to seem burthensome, which should never in any degree be given up: he loses that respect, and often that confidence, which he should have towards his officers; and indulgence often makes a well-disciplined body become a set of sluggards, who march against their will, and who, on the most pressing emergencies, think only on their own safety.

The Romans have left us examples both of indulgence and severity: no people ever took more properly the opportunities of punishing or forgiving. Manlius caused his son to be punished with death, for a disobedience which at any other time would have merited the honours of a triumph. Varro was applauded for an imprudence, which at another juncture would have caused his death. In the time of the republic, it was necessary to be severe, because, as every Roman could aspire to the same rank, it would have been dangerous that small crimes against the community had remained unpunished; such impunity would have countenanced enterprises which might have destroyed the whole system of their political government.

The ability, foresight, and prudence of a General, gain him the entire confidence of both officer and soldier. The soldier indeed judges but by instinct, and is determined only

only by the event ; but his judgement is not less infallible : that of an officer is equally just ; but he is determined only by full conviction ; he puts event out of the question, and places his confidence in nothing but courage and prudence. Confidence is, again, to be acquired by affability to those who are subordinate to us, and by supplying their wants before they are complained of : these two motives for confidence afford a plentiful and certain harvest of laurels to the General. The present King of Prussia, Marshal Luxembourg, Marshal Turenne, Prince Eugene, the Duke of Marlborough, Marshal Saxe, General Wolfe, and many others, have owed the advantages they gained of their enemies, to the confidence of the soldiers ; who, loving their General, considered it as their duty to please him, and had no joy in victory, but as they shared it with him.

Besides these qualities, which are essential to a General, and which all who would attain that high rank should of course have, there are still many others necessary to make a Great Man. A Hero requires fewer virtues : the Great Man is always a good member of the community ; he considers humanity as his first duty ; he is just, open, and unbiassed ; his temper may be fiery, but this ardour is always regulated by prudence ; he gives advice with the same openness as he would ask it ; and never asks but of those whose experience, which he estimates rather by their actions than their age, makes them capable of giving such as may be trusted ; he is haughty only to his enemies, free to his equals, affable to his inferiors, brave without either arrogance or rashness, and easy of access to all.

The General should be acquainted with the interests and force of Princes (a knowledge very necessary in judging of the power of Princes upon whom war is made, that he may fall sooner upon the country of him who can obstruct his projects, than upon a Prince who, by the situation of his dominions and force, can make no opposition). In a word, a General who would merit the title of a Great Man, should unite in himself all civil, military, and political excellence. It is by this, that he will easily attain to make war with success : nothing will escape him : he will know, without difficulty, the genius of every country, and of the nations which compose the enemy's army ; the abilities of the Generals who command, and the nature of the troops under them. Without these precautions he would never think that he could act upon certain grounds : he knows he may venture a motion with some troops, which he would not dare to attempt with others that are equally brave. One nation is vehement, fiery, and formidable, in the first onset ; another is not so hasty, but of more perseverance : with the former, a single instant determines success ; with the latter, the action is not so rapid, but the event is less doubtful.

No man is born a General, though he brings into the world with him the seed of those virtues which make a Great Man. Cæsar, Spinola, Turenne, the great Condé, Eugene, Marlborough, Wolfe, and some others, showed, even in their earliest years, such qualities as ranked them above other men : they carried with them the principles of those great virtues which they drew forth to action by profound study, and which they brought to perfection by the help of practice : those who came after them, with perhaps fewer natural talents, have by study rendered themselves worthy of being compared to them. Cæsar and all conquerors had this advantage, that they were able to make their own opportunities, and always acted by their own choice. A man may be a good General without being a Turenne : such geniuses are scarcely seen once in an age ; but the more they are raised above the rest of mankind, the more they should excite emulation. It is by endeavouring to surpass the intellects of the second rate,—it is by striving to surpass, or at least to equal the most sublime, that the imitation of them is to be attained. This passion in a soldier is neither pride, nor presumption ; it is
virtue,

virtue; and it is by this only, that he can hope to be serviceable to the State, and add to the glory of his King.

How much soever the honour of commanding armies may be sought after, it degrades him who is not worthy of it: this rank, so much desired, borders on the two extremes of glory and ignominy. A military man, who labours to make himself capable of commanding, is not to be blamed; his ambition is noble: by studying the art of commanding, he learns that of obeying, and of executing.

I should be astonished in the highest degree, if I saw soldiers thinking only on preferment, and neglecting the study of their business; I should perhaps wonder less if I saw others, without having been tried, proposing to themselves to command in chief; because such attempts suppose in the projector an absurd temerity, founded on a profound ignorance of the talents he should have, and the virtues which he has not. Such boldness is the character of a man whose mind is too narrow to perceive his danger. I should rather approve the timidity that suffers itself to be dejected by terror, since it shows, at least, that he knows to what hazards he is exposed. Both are blameable. Modesty is the only proper quality of a soldier; it gives splendor to virtue; it argues diffidence of himself, and a desire of arriving at perfection.

Mardonius, Xerxes's General, proposed himself to the King to command his armies: this conceit of his own talents should have been answered by a refusal: the innumerable troops which he led were defeated by a small number of Greeks, and his presumption served but to increase the misfortune of his Prince. Cincinnatus, endowed with every quality, both of a great man and a great soldier, was holding his plough when the Romans came to intrust the fate of the republic to him: he set out, and Rome was delivered from her enemies.

The title of General would be less tempting, if proper attention was paid to the qualities it requires, and the duties it imposes: it would then appear a very honourable, but painful burthen. The most firm and intrepid genius might be discouraged, merely thinking that on the conduct of a General depends the fate of his country, the fate of his Prince's arms, and his own reputation.

yet the reward that follows such irksome labours should animate men to undertake. Obstacles, however numerous they may be, are not insurmountable, since great men have got the better of them: difficulties should stir up a soldier's emulation, but should never terrify him; he should endeavour to copy such great originals, though he may not be able to equal them.

This work has engaged my utmost application for some years. Several performances on the same subject have already appeared in different languages, but none in our own, except Watson's *Military Dictionary*, and a *New Military Dictionary; or The Field of War, by a Military Gentleman*. Far from exhibiting an enlarged and comprehensive view of military affairs, these productions are extremely imperfect, according to the very circumscribed plan which their authors have adopted; the first being only a small duodecimo pamphlet, and the latter containing an account of the most remarkable battles, sieges, bombardments, and expeditions, whether by sea or land; such as relate to Great-Britain and her dependencies, deduced from the descent of Julius Cæsar to the year 1760, in alphabetical order. These, together with our best dictionaries of arts and sciences, are so very imperfect and obsolete in the different terms and machinery of war, as not only to be very vague and perplexed, but even unintelligible. With regard to its internal government in action, to the general regulations of the line of battle, of marches, retreats, encampments, sieges, mining, artillery, and to the principal movements in manœuvring and tactics, they are almost totally silent. Had any of these works been executed with tolerable success, our various military authors would

would not have been under the necessity of adding a vocabulary to the end of their works, to explain the military terms they made use of.

The study of the Art of War is generally allowed to be the most difficult of any ; yet I am of opinion, that this art, like all others, is founded on certain and fixed principles, which are by their nature invariable : the application of them only can be varied ; but they are in themselves constant. This most difficult science may, I think, be divided into two parts. The one is mechanical, and may be taught by precepts : the other has no name, nor can it be defined or taught : however, it consists in a just application of the principles and precepts of war, in all the numberless circumstances and situations which occur : no rule, no study or application, however assiduous ; no experience, however long, can teach this part : it is the effect of genius alone. As to the first, it may be reduced to mathematical principles ; its object is, to prepare the materials which form an army, for all the different operations which may occur : genius must apply them according to the ground, numbers, species, and quality of the troops, which admit of almost infinite combinations.

But, as this laborious task requires too much time to be attempted by the far greater part of those who are desirous of being thoroughly acquainted with the military arts and sciences, in their present state of improvement and perfection ; this DICTIONARY is offered to the Public as a great help to that branch of knowledge : and I hope that the great pains I have taken, and the many years I have spent, in composing and perfecting this work, will render it an acceptable acquisition to my Country.

Animated with a sincere desire of making myself useful to the Public, I undertook this laborious task, and have exerted all my abilities to remove every difficulty, and smooth the path that leads to the temple of military sciences.

In order to effectuate this, I have been particularly careful to explain, in the most conspicuous and intelligible manner, the principles upon which every branch of the art of war is founded ; and from these general principles, I have deduced and elucidated the various terms in martial discipline, fortification, gunnery, mining, and sieges ; particularly those now actually practised by the most famous belligerent powers in Europe.

How far this work may prove advantageous, must be left to time and experience ; only hope, that an undertaking so evidently calculated to promote the military arts, cannot fail of meeting with encouragement, in an age when heroic prowess is to the summit of perfection.

Royal MILITARY ACADEMY,
Woolwich, Nov. 25, 1778.

GEORGE SMITH.

Principal AUTHORS perused in compiling the following W O R K.

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E R R A T A.

ARTILLERY-Park, line 10, for *incampment*, read *encampment*.

Incampment of a regiment of ARTILLERY, read *Encampment*.

ASSEMBLEE, read ASSEMBLY.

BATTERING-Train, line 5, for *the 10 and 8-inch*, read *the 13, 10, and 8-inch*.

Shoulder-BELTS, line 2, for, *and to which the pouch fixed*, read *and to which the pouch is fixed*.

BOYAU, line 5, for, *that it may be enfiladed*, read *that it may not be enfiladed*.

BULLETS, table thereof, last figure in the head column, which stands 6, read 9.

Ancient and present names of Cannon, at the paragraph, *ship-guns*, for 42, 36, 32, read 42, 32, &c.

CANTONMENTS, line 3, for *incampment*, read *encampment*.

COURT-Martial, line 2, for *offences*, read *offences*.

COMPLEMENT, read COMPLIMENT.

DAGGER, line 3, for, *it is not long that since*, read, *it is not long since that*, &c.

How to find the DIAMETER, line 26, for 0586971 $\frac{1}{2}$, read, 0586971 $\frac{3}{4}$.

FORGE. *Dimensions of a travelling-FORGE*, for *fore-wheels height* 104, read 64; for *hind wheels height* 64, read 104.

Dimensions of tin TUBES, &c. first column, for 5 $\frac{1}{2}$ royal coborn, dele coborn; also, for 4 $\frac{1}{2}$ royal coborn, dele royal.

WHEEL, art. 11, line 10, for $\frac{F}{w}$, read $\frac{F}{W}$, &c. Art. 14, line 6, for *to the R*, read *to R*.

S U P P L E M E N T.

CAMP, at the paragraph, *Distribution of the front and depth of the CAMP, for a battalion of infantry*, line 11, for, *the depth 759 feet, formerly 960*, dele the whole.

LABORATORY, in the *table of fuzes*, at the 9th column, top line, for 35 to 3, read 35 to 38.

LABORATORY, *table of shells ranges*, &c. at *Example 2*, line 10, for $\sqrt{2216}$, read $\sqrt{2316}$.

MILITARY DICTIONARY



A B B

ABBATIS, in a military sense, is formed by cutting down many entire trees, the branches of which are turned towards the enemy, and as much as possible entangled one into another. They are made either before redoubts, or other works, to render the attacks difficult, or sometimes along the skirt of a wood, to prevent the enemy from getting possession of it. In this case the trunks serve as a breast-work, behind which the troops are posted, and for that reason should be disposed, so as that the parts may, if possible, flank each other.

ABSOLUTE *Gravity*, in philosophy, is the whole force by which a body, shell, or shot, is impelled towards the center. See **GRAVITY**.

ABSOLUTE *Number*, in Algebra, is the known quantity which possesses entirely one side of the equation. Thus, in the equation, $x^2 + 10x = 64$, the number 64, possessing entirely one side of the equation, is called the *absolute number*, and is equal to the square of the unknown root x , added to $10x$, or to 10 times x .

ACADEMY, in antiquity, the name of a villa situated about a mile from the city of Athens, where Plato and his followers assembled for conversing on philosophical subjects; and hence they acquired the name of Academics.

Military ACADEMY. We have in England two royal military academies, one at Woolwich, and one at Portsmouth. The first was established by his late Majesty king George II. by warrants bearing date the 30th day of April, and the 18th day of November, 1741, endowed, and supported, for the instructing of the people

A C C

belonging to the military branch of ordnance, in the several parts of mathematics necessary to qualify them for the service of the artillery, and the business of engineers. The lectures of the masters in theory were then duly attended by the practitioner-engineers, officers, sergeants, corporals, private men, and cadets. At present the gentlemen educated at this academy are the sons of the nobility and military officers. They are called gentlemen-cadets, and are not admitted under 13 years of age. They are taught writing, arithmetic, algebra, Latin, French, mathematics, mechanics, surveying, levelling, and fortification, together with the attack and defence; gunnery, mining, laboratory-works, geography, perspective, fencing, dancing, &c. The master-general of the ordnance is always captain of the company of gentlemen-cadets, and some officer of merit is always captain-lieutenant. There is, besides, a first lieutenant, and two second lieutenants. They are further under the immediate care of a lieutenant-governor, and an inspector, who are officers of great abilities and experience; and the professors and masters are men of known talents and capacity. That at Portsmouth was founded by George I. in 1722, for teaching those branches of the mathematics which more immediately relate to navigation.

ACCELERATED
Motion.

{ *on oblique or inclined planes. See MOTION.*
of pendulums. See PENDULUMS.
of projectiles. See PROJECTILES.

A C C

ACCENSI, in antiquity, were officers attending the Roman magistrates; their business was to summon the people to the public games, and to assist the prætor when he sat on the bench.

Accensi, in the Roman armies, were, according to Festus, supernumerary soldiers, whose duty it was to attend their leaders, and supply the places of those who were either killed or wounded. Livy mentions them as irregular troops, who were but little esteemed. Salmastius tells us, they were taken out of the fifth class of the poor citizens of Rome.

ACCESSIBLE, that which may be approached. We say, in a military stile, that place, or that fortress, is *accessible* from the sea, or land, i. e. which may be entered on those sides.

An accessible height or distance, in geometry, is that which may be measured by applying a rule, &c. to it; or rather, it is a height, the foot whereof may be approached, and from whence any distance may be measured on the ground.

Heights, both accessible, and inaccessible, may be taken with a quadrant. See **ALTITUDE**.

One of the objects of surveying, is the measuring both accessible and inaccessible distances.

ACCLIVITY, in a military sense, is the steepness or slope of any work, inclined to the horizon, reckoned upwards. Some writers on fortification use acclivity as synonymous to *talus*; though *talus* is commonly used to denote all manner of slopes, either in its ascendent or descendent state.

ACCOUTREMENTS, in a military sense, signifies habits, equipage, or furniture, of a soldier, such as buffs, belts, pouches, cartridge-boxes, &c.

ACLIDES, in Roman antiquity, a kind of missile weapon, with a thong fixed to it, whereby it might be drawn back again. Most authors describe the *aclides* as a sort of dart or javelin; but Scaliger makes it roundish or globular, with a wooden stem to poise it by.

ACTIAN games, in antiquity, were solemn games instituted, or at least restored, by Augustus, in memory of the famous victory, at Actium, over Mark Anthony.

ACTIAN years, in chronology, a series of years, commencing with the epocha of the battle of Actium, otherwise called the æra of Augustus.

ACTION, in the military art, is an engagement between two armies, or any smaller body of troops, or between different bodies belonging thereto. The word is likewise used to

A D V

signify some memorable act done by an officer, soldier, or even commander of a detachment or party.

ACTIVITY, in a military sense, denotes laboriousness, attention, labour, diligence and study.

ACUTE angle. See **ANGLE**.

ADJUTANT-GENERAL is an officer of distinction, who aids and assists the general in his laborious duty: he forms the several details of duty of the army, with the brigade-majors, and keeps an exact state of each brigade and regiment, with a roll of the lieutenant-generals, major-generals, colonels, lieutenant-colonels, and majors. He every day at head quarters receives orders from the general officer of the day, and distributes them to the majors of brigades, from whom he receives the number of men they are to furnish for the duty of the army, and informs them of any detail which may concern them. On marching days he accompanies the general to the ground of the camp. He makes a daily report of the situation of all the posts placed for the safety of the army, and of any changes made in their posts. In a day of battle the adjutant-general sees the infantry drawn up, after which he places himself by the general to receive any orders. In a siege he visits the several posts and guards of the trenches, and reports their situation, and how circumstanced: he gives and signs all orders for skirmishing parties (if time permits) and has a serjeant from each brigade to carry any orders which he may have to send.

ADJUTANT, an officer who eases the major of part of the burthen of his duty, and performs it all in his absence. He receives orders from the brigade-major, if in camp; and when in garrison, from the town-major: after he has carried them to his colonel or officer commanding the regiment, he then assembles the serjeant-major, drum-major, and fife-major; with a serjeant and corporal of each company, who write the orders to shew to their respective officers. If convoys, parties, detachments, or guards, are to be furnished, he gives the number which each company are to furnish, and hour and place for their assembling: he must keep an exact roster and roll of duties, and have a perfect knowledge of all manœuvres, &c. Each troop of guards has two adjutants, every regiment of foot has one, and each battalion of the royal artillery one. This post is always given to a subaltern.

ADVANCEMENT, in a military sense, signifies honour, promotion, or preferment, in the army, regiment, or company.

ADVANCED

ADVANCED { **FOSSE.** } See FORTIFICATION.
 { **DITCH.** }
 { **GUARD.** } See GUARD.

AFFIDAVIT, in military law, signifies an oath taken before some person who is properly authorized to take it; as first, when a soldier is enlisted; secondly, by all officers appointed for a court-martial; thirdly, by the commissaries, or muster-masters.

AFFUT, the French name for a gun-carriage, and for which we have no proper name; the only distinction from all other carriages is, that it belongs to a gun. See CARRIAGE.

AGA, in the Turkish army, is the same as a general with us.

AGENT, to a regiment or battalion, signifies a person entrusted with all the money belonging to both officers and private men: he keeps exact accounts of the arrears of commissioned officers, in regard to subsistence, poundage, hospital, widows, and off-reckonings. He is generally appointed by the colonel of the regiment.

AGLADES, in the Turkish armies, are a kind of pioneers employed in fortifying the camp, &c. This word frequently occurs in history.

AID-DE-CAMP, an officer appointed to attend a general officer, in the field, in winter-quarters, and in garrison; he receives and carries their orders, as occasion requires. He is seldom under the degree of a captain, and all aids-de-camp have 10s. a day allowed for their duty. This employment is of greater importance than is generally believed: it is, however, often entrusted to young officers of little experience, and of as little capacity; but in most foreign services they give great attention to this article. Marshal de Puységur mentions the loss of a battle through the incapacity of an aid-de-camp.

King's Aids-de-Camp, are frequently officers of note; and by this promotion they always rank as colonels.

AID-MAJOR. See ADJUTANT.

AIM-FRONTLET, a piece of wood hollowed out to fit the muzzle of a gun, to make it of an equal height with the breech, formerly made use of by the gunners, to level and direct their pieces. It is not used at present.

AIR-GUN, a pneumatic machine for exploding bullets, &c. with great violence.

The common air-gun is made of brass, and has two barrels: the inside barrel is of a small bore, from whence the bullets are exploded; and a large barrel on the outside of it. There is likewise a syringe fixed in the stock of the

gun, by which the air is injected into the cavity between the two barrels through a valve. The ball is put down into its place in the small barrel with the rammer, as in any other gun. Another valve, being opened by the trigger, permits the air to come behind the bullet, so as to drive it out with great force. If this valve be opened and shut suddenly, one charge of condensed air may be sufficient for several discharges of bullets; but if the whole air be discharged on one single bullet, it will drive it out with uncommon force. This discharge is effected by means of a lock placed here, as usual in other guns; for the trigger being pulled, the cock will go down and drive the lever, which will open the valve, and let in the air upon the bullet.

In the air-gun, and all other cases where the air is required to be condensed to a very great degree, it will be requisite to have the syringe of a small bore, viz. not exceeding half an inch in diameter; because the pressure against every square inch is about 15 pounds, and therefore against every circular inch about 12 pounds. If therefore the syringe be one inch in diameter, when one atmosphere is injected, there will be a resistance of 12 pounds against the piston; and when 10 are injected, there will be a force of 120 pounds to be overcome; whereas 10 atmospheres act against the circular half-inch piston (whose area is only $\frac{1}{4}$ part so big) with only a force equal to 30 pounds; or 40 atmospheres may be injected with such a syringe, as well as 10 with the other. In short, the facility of working will be inversely as the squares of the diameter of the syringe.

AIR-SHAFTS, in mining. See MINING.

AJUTANT. See ADJUTANT.

ALARM, is a sudden apprehension upon some report, which makes men run to their arms to stand upon their guard; it implies either the apprehension of being suddenly attacked, or the notice given of such an attack being actually made; generally signified by the firing of a cannon, the beat of a drum, &c.

ALARM-Post, in the field, is the ground appointed by the quarter-master general for each regiment to march to, in case of an alarm.

ALARM-Post, in a garrison, is the place allotted by the governor for the troops to draw up in, on any sudden alarm.

False-ALARMS, are stratagems of war, frequently made use of to harraß an enemy, by keeping them perpetually under arms. They are often conveyed by false reports, occasioned by a fearful or negligent sentinel. A vigilant

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officer will sometimes make a false alarm, to try if his guards are strict upon duty.

ALARM-Bell, the bell rung upon any sudden emergency, as a fire, mutiny, approach of an enemy, or the like.

Knights of ALCANTARA, a Spanish military order, who gained great honour during the wars with the Moors.

ALIEN, in law, implies a person born in a foreign country, not within the king's dominions, in contradistinction to a denizen, or natural-born subject.

ALLEGIANCE, in law, implies the obedience which every subject ought to pay to his lawful sovereign.

Oath of ALLEGIANCE, is that taken by the subject, by which he acknowledges the king his lawful sovereign.

ALLIANCE, in a military sense, signifies a treaty entered into by sovereign princes and states, for their mutual safety and defence. In this sense alliances may be distinguished into such as are offensive, whereby the contracting parties oblige themselves jointly to attack some other power, and into such as are defensive, whereby the contracting powers bind themselves to stand by, and defend one another, in case of being attacked by any other power.

ALLOY, is the mixture of metals that enter into the composition of the metal proper for cannon and mortars.

ALMADIE, a kind of military canoe, or small vessel, about 24 feet long, made of the bark of a tree, and used by the negroes of Africa.

ALMADIE, is also the name of a long-boat used at Calcutta, near 80 feet long, and generally six or seven broad.

ALTITUDE, height, or distance from the ground, measured upwards, and may be both accessible and inaccessible.

ALTITUDE of motion, a term used by some writers, to express the measure of any motion, computed according to the line of direction of the moving force.

AMAZON, one of those women who inhabited the country so called. They are said to have composed a nation of themselves, exclusive of males, and to have derived their name from their cutting off one of their breasts, that it might not hinder or impede the exercise of their arms. This term has often by modern writers been used to signify a bold daring woman, whom the delicacy of her sex does not hinder from engaging in the most hazardous attempts. The last and former wars with France have furnished us with several in-

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stances of females who have undergone the fatigue of a campaign with alacrity, and run the hazards of a battle with the greatest intrepidity.

AMBITION, in a military sense, signifies a desire of greater posts, or preferment. Every gentleman in the army, or navy, ought to have a spirit of ambition to arrive at the very summit of their profession.

AMBUSCADE, in military affairs, implies a body of men posted in some secret or concealed place, 'till they find an opportunity of falling upon the enemy by surprise: or, they are rather snares set for the enemy, either to surprise them when marching without precaution, or by posting yourself advantageously, and drawing them there by different stratagems, to attack them by superior force. An ambuscade is easily carried into execution in woods, buildings, and hollow places; but requires a more fertile imagination, and greater trouble, in a level country.

AMBUSH, a place of concealment for soldiers to surprise an enemy, by falling suddenly upon them.

AMENDE Honorable, in the French customs, is an infamous kind of punishment inflicted upon traitors, parricides, or sacrilegious persons, in the following manner: the offender being delivered into the hands of the hangman, his shirt is stripped off, a rope put about his neck, and a taper in his hand; then he is led into court, where he must beg pardon of God, the king, the court, and his country. Sometimes the punishment ends here; but sometimes it is only a prelude to death, or banishment to the galleys.

AMMUNITION, implies all sorts of warlike stores, and more particularly powder and ball, cannon, mortars, howitzers, cohorns, royals, shells, bullets, cartridges, grape-shot, tin, and case-shot; carcasses, grenades, pontoons, small-arms, swords, forage, stores, &c.

AMMUNITION bread, shoes, cloths, &c. such as are served out by the government, to the soldiers of an army, garrison, &c. The bread that is provided for, and distributed to the soldiers, is a loaf of six pounds every four days, to each soldier.

AMMUNITION-waggon, is generally a four-wheel carriage with shafts; the sides are raised in with staves and raves, and lined with wicker-work, so as to carry bread and all sorts of tools. It is drawn by four horses, and loaded with 1200 pound weight. See **WAGGON**.

AMMUNITION-cart, a two-wheel carriage with shafts; the sides of which, as well as the fore

fore and hind parts, are inclosed with boards instead of wicker-work.

AMNESTY, in a military or political sense, is an act by which two belligerent powers at variance promise to forget and bury in oblivion all that is past.

AMNESTY is either general and unlimited, or particular and restrained, though most commonly universal, without conditions or exceptions; such as that which passed in Germany at the peace of Osnabrug in the year 1648.

AMNESTY, in a more limited sense, denotes a pardon granted by a prince to his rebellious subjects, usually with some exceptions; such as was granted by Charles II. at his restoration.

AMORCE, an old military word for fine-grained powder, such as is sometimes used for priming of great guns, mortars or howitzers; as also for small-arms, on account of its rapid inflammation.

AMPLITUDE of the range of a projectile. See **PROJECTILE**.

ANABASII, in antiquity, were expeditious couriers, who carried dispatches of great importance, in the Roman wars.

ANCYLE, in antiquity, a kind of shield which fell, as was pretended, from heaven, in the reign of Numa Pompilius; at which time, likewise, a voice was heard, declaring that Rome should be mistress of the world as long as she should preserve this holy buckler.

Authors are much divided about its shape: however, it was kept with great care in the temple of Mars, under the direction of twelve priests; and, lest any should attempt to steal it, eleven others were made so like it, as not to be distinguished from the sacred one. These *Ancylia* were carried in procession every year round the city of Rome.

St. ANDREW, or the *Thistle*, a military order of knighthood in Scotland. The occasion of instituting this order is variously related by different authors. John Lesley, bishop of Ross, reports, that the night before the battle betwixt Athelstane, king of England, or rather Northumberland, and Hungus, king of the Picts, a bright cross, in the fashion of that whereon St. Andrew suffered martyrdom, appeared in the air to Hungus; he having gained the victory, bore the figure of that cross at all times after in his ensigns and banners, from which time all succeeding kings of Scotland have religiously observed the same bearing. Others assert, that this extraordinary appearance was not to Hungus, but to the Scots, whom Achaius, king of Scotland, sent to his assistance. This victory is said to be obtained

in the year 819 (though, according to Buchanan, Achaius died nine years before) and that Hungus and Achaius went bare footed in a solemn procession to the Kirk of St. Andrew, to return thanks to God and his apostle, declaring that they and their posterity would ever use in their ensigns the cross of St. Andrew; which custom prevailed among the Picts, and continued among the Scots unto this day: and that both these kings instituted an order, which they named the order of St. Andrew.

Others, who allow that Achaius instituted this order, give the following account of its origin: Achaius having formed that famous league, offensive and defensive, with Charlemagne, against all other princes, found himself thereby so strong, that he took for his device the *Thistle* and the *Rue*, which he composed into a collar of his order, and for his motto, *Pour ma defense*; intimating thereby, that he feared not the powers of foreign princes, seeing he leaned on the succour and alliance of the French. And though from hence may be inferred, that these two plants, the Thistle and the Rue, were the united symbols of one order of knighthood, yet Menenius divides them into two, making one whose badge was the Thistle, whence the knights were so called, and the motto, *Nemo me impune lacessit*; another vulgarly called *Sertum rute*, or the garland of rue; the collar of which was composed of two branches or sprigs thereof, or else of several of its leaves: however, at both these collars hung one and the same jewel, to wit, the figure of St. Andrew, bearing before him the cross of his martyrdom.

But though the thistle has been acknowledged for the badge and symbol of the kingdom of Scotland, even from the reign of Achaius, as the rose was of England, and the lily of France, the pomegranate of Spain, &c. yet there are some who refer the order of the thistle to later times, in the reign of Charles VII. of France, when the league of amity was renewed between that kingdom and Scotland, by which the former received great succour from the latter, in the time of an extraordinary distress. Others again place the foundation still later, even as low as the year 1500; but without any degree of certainty.

The chief and principal ensign of this order is a gold collar, composed of thistles, interlinked with annulets of gold, having pendent thereto the image of St. Andrew with his cross, and this motto, *Nemo me impune lacessit*.

Knights of St. ANDREW, is also an order instituted by Peter the Great, of Muscovy, in 1698; the badge.

badge of which is a golden medal, on one side whereof is represented St. Andrew's cross; and on the other are these words, *Czar Pierre maitre de toute la Russie*. This medal, being fastened to a blue ribbon, is suspended from the right shoulder.

ANGLE, in geometry, is the inclination of two lines meeting one another in a point.

Thus if the line CB (*plate I. fig. 1.*) meet the line DB , in the point B , their inclination towards each other is called an angle.

Sometimes angles are denoted by a single letter placed at the point of intersection; as the angle B (*fig. 2.*) imports the angles formed by the lines AB, CB , at the point B . But when several lines meet at the same point, as at B (*fig. 3.*) each particular angle is denoted by three letters, whereof the middle letter shews the angular point, and the other two letters the lines which form that angle. Thus the angle formed by the lines AB, CB , at the point B , is called the angle ABC , or CBA .

The measure of an angle is the arch of a circle, described on the angular point, intercepted between the two lines which form the angle. Thus the measure of the angle ABC (*fig. 3.*) is the dotted arch intercepted between the two legs AB, CB ; and as many degrees, &c. as are contained in that arch, so many degrees, &c. the angle ABC is said to consist of.

Hence it will be easy to measure the quantity of any angle geometrically; for if you take the distance of the arch intercepted between the lines AB, CB , and apply it to a line of chords, whose radius is BE , you will have the number of degrees, &c. contained in the angle ABC . Or if you apply the center of a protractor to the angular point B , in such a manner that the leg AB lies directly under the limb of the protractor, the degree on the arch cut by the other leg BC will give the quantity of the angle required.

ANGLES are either *right, acute, or obtuse*.

A **Right ANGLE**, is that whose two legs are perpendicular to each other; and consequently the arch intercepted between them is exactly 90° . Thus the angle ABC (*fig. 2.*) is a right angle.

An **Acute ANGLE**, is that which is less than a right angle, or 90° . as the angle CBD , *fig. 1.*

An **Obtuse ANGLE**, is that which is greater than a right angle; as ABC , *fig. 1.*

Adjacent ANGLES, are such as have the same vertex, and one common side contained beyond the angular point. Thus the angle CBD , and CBA (*fig. 1.*) are adjacent angles. The sum

of these adjacent angles is always equal to two right angles (*13. Eucl. 1.*) and therefore, if one of them be acute, the other will be obtuse; and the contrary: whence, if either of them be given, the other is also given, it being the complement of the former to 180° .

Vertical ANGLES, are the opposite angles made by two lines cutting or crossing each other. Thus, if the right lines AB, CB (*fig. 4.*) cut or cross each other in the point E , then the angles AEC, DEB , and AED, CEB , are vertical angles. Hence, when two lines cut or cross each other, the vertical angles are equal (*15. Eucl. 1.*)

Alternate ANGLES, are those cut or obtuse angles made by two lines cutting or crossing each other, and formed by a right line cutting or crossing two parallel lines. Thus, if AB (*fig. 5.*) be parallel to CD , and the line GH cuts them in I and K , then are the angles AIK, DKL , and BIK, IKG , alternate angles. These alternate angles are always equal to each other (*18. Eucl. 1.*)

A **Rectilinear ANGLE**, is made by straight lines, to distinguish it from the spherical or curvilinear angle.

Spherical ANGLE, is an angle formed by the intersection of two great circles of the sphere. Thus let $ACDE$ (*fig. 6.*) represent a sphere, upon whose surface let two arches of great circles AB, CE , be drawn intersecting each other in D ; then will ADC, DCA, BDE , or DBE , be a spherical angle. All spherical angles are measured by an arch of a great circle described on the vertex as a pole, and intercepted between the legs which form the angle. Thus AC is the measure of the spherical angle ADC , which is equal to the distance between the poles of the circles AB, CE .

Mixed-lined ANGLE, is that comprehended between a right line and a curved line; as the angle ABC (*fig. 1.*)

Curved-line ANGLE, is that intercepted between two curved lines meeting each other in one point, in the same plane; as the angle BCA (*fig. 8.*) which is intercepted between the two curved lines AC and BC . If the right lines DC, EC , are equal to the radii of the curves BC and AC , the right-lined angle DCE will be equal to the curved-line angle ACB . For, because the angle $DCB = ECA$, therefore, if from each be taken the common angle DCA , there will remain the angle $DCE = ACB$.

Angle of Incidence, is that which the line of direction of a ray of light, &c. makes at the point where it first touches the body it strikes

strikes against, with a line erected perpendicular to the surface of that body. Thus, if a ray of light, &c. moves in the direction *AB* (fig. 3.) till it touches the surface *abcd*, in the point *B*, then will the angle intercepted between *AB*, the line of direction, and the perpendicular *BF*, be the angle of incidence.

ANGLE of Reflection, is the angle intercepted between the line of direction of a body rebounding, after it was struck against another body, and a perpendicular erected at the point of contact. Thus, if a body moving in the direction *AB* strike the surface *abcd* (fig. 3.) in the point *B*, and is reflected in the direction *BC*, the angle, contained between that line and the perpendicular *BF*, is called the angle of reflection. The angle of incidence is always equal to the angle of reflection; and upon this equality the whole science of catoptrics is founded.

ANGLE at the center, in fortification, is that which is formed in the center of the polygon or figure, by two lines proceeding from the center, and terminating at the two nearest angles of the polygon. See FORTIFICATION.

ANGLE of the curtain, } That which is made
ANGLE of the flank, } by, and contained
between, the curtain and the flank.

ANGLE of the polygon, that which is made by the meeting of the two sides of the polygon, or figure in the center of the bastion. See FORTIFICATION.

ANGLE of the triangle, is half the angle of the polygon.

ANGLE of the bastion, or } That which is made
Flanked ANGLE, } by the two sides,
being the utmost part of the bastion most exposed to the enemies batteries, frequently called the point of the bastion. See FORTIFICATION.

Diminished ANGLE, only used by some foreign engineers, and more especially the Dutch, is composed of the face of the bastion, and the exterior side of the polygon.

ANGLE of the shoulder, or } Is formed by one
ANGLE of the epaule, } face, and one flank
of the bastion. See FORTIFICATION.

ANGLE of the tenaille, } Is made by two lines
ANGLE reentrant, } fichant, that is, the
faces of the two bastions extended, 'till they meet in an angle towards the curtain, and is that which always carries its point towards the outworks. See FORTIFICATION.

ANGLE of the flank exterior, is that which is before the center of the curtain, formed by the prolongation of the faces of the bastion, or by both the fichant lines of defence, intersecting each other on planning a fortification.

ANGLE of the flank interior, is formed by the flanked line of defence and the curtain; being that point where the line of defence falls upon the curtain.

ANGLE of the line of defence, is that angle made by the flank, and the line of defence.

ANGLE of the face, is formed by the angle of the face, and the line of defence produced 'till they intersect each other.

ANGLE of the base interior, is the half of the figure, which the interior polygon makes with the radius, when they join each other in the center; intersecting the center of the gorges of each bastion.

ANGLE of the base exterior, is an angle formed by lines drawn from the center of the figure, to the angle of the exterior polygon, cutting the center of the gorges of each bastion.

ANGLE of the gorge, is that angle formed by the prolongation of the curtains, intersecting each other, in the center of the gorge, through which the capital line passes.

ANGLE of the ditch, is formed before the center of the curtain, by the outward line of the ditch.

Flanked ANGLE. See **ANGLE of the bastion**.

Salient ANGLE, } Is that angle which points
ANGLE fortant, } outwards, or towards the
country. Such is the angle of the counterescarp before the point of a bastion.

Entering ANGLE, or } An angle pointing in-
ANGLE reentrant, } wards, as the salient
angle does outwards. Such is the angle of the counterescarp before the curtain.

ANGLE of the counterescarp, made by two sides of the counterescarp, before the center of the curtain.

ANGLE of the circumference, is the mixed angle formed by an arch, drawn from one gorge to another.

Re-entering ANGLE. See **Entering ANGLE**.

ANGLE of the complement of the line of defence, is the angle formed by the intersection of the two complements with each other.

ANGLE of a battalion, made by the last men at the extremity of the ranks and files.

Front ANGLES, the two last men of the front rank.

Rear ANGLES, the two last men of the rear rank.

Dead ANGLE, is a re-entering angle, consequently not defended.

ANGULAR, in a general sense, denotes something relating to, or that hath angles.

ANGON, in ancient military history, was a kind of dart of a moderate length, having an iron bearded head and cheeks; much in use about the fifth century.

To ANIMATE, in a military sense, is to encourage the troops by the power of language. That art, that power, which can on singular and critical occasions so animate the spirit of man, as to cause it to give an elasticity, a strength, a velocity, to the corporal matter of the being, which unanimated it would be incapable of doing; such art, such power, must be ever necessary to a leader of soldiers. He who is, in particular cases, to point out to others their duty, who is sometimes to dissipate their fears, rouse their courage, shew advantages, or lessen unfavourable appearances, should have the power to animate by speech: if he has not, he himself may meet with disgrace, where he might have found triumph; and his men be beat, where they might have conquered. Innumerable instances might be brought to prove the truth of this assertion. All addresses to animate soldiers have been reserved, and used as last resources for rare, trying, and critical situations; and in such sense alone is the power *to animate* by speech here treated of.

All officers know, that in any event of danger, the soldiers always look at their officers, their commanding one in particular, if they have confidence in him, to see how he feels himself, whether he is unperplexed, and seems to be easy; and from his looks they will often augur good or bad success; and from his appearance or actions often spring assurance and victory, dismay and defeat. Actions or appearances of officers should never lead to give soldiers room to doubt, or to form unfavourable conjectures: what they see from the enemy cannot be prevented; but they should neither see, hear, nor understand any bad omens from their own side: if they ever see too much, means, if possible, should be made use of, to make them distrust and forget their own sight, and see only through the medium of their commanding officer's words and inclinations. Animation, like electricity, is communicated, is catching; and the officer who is animated himself, will inspire others.

All history, particularly the ancient, presents numbers of examples of armies, of small parties, extricating themselves from dangerous and alarming situations, through the exhortations of their chiefs; and when any chief directs the method of escape, or shews the road to victory, by a few words; and with his person, if necessary, sets the example of a successful execution, armies, and parts of armies, in general will escape, and will conquer. If soldiers

opinions are then to be changed by words, or by appearances, and from such change of opinion, victory will often ensue; hence to animate by speech at particular times, becomes a matter of the utmost importance.

ANNALS, a species of military history, wherein events are related in the chronological order they happened. It differs from a perfect history, in being only a meer relation of what passes every year, as a journal is of what passes every day.

ANNUNCIADA, an order of military knighthood in Savoy, first instituted by Amadeus I. in the year 1409; their collar was of 15 links, interwoven one with another, and the motto *P. E. R. T.* signifying *fortitudo ejus Rhodum tenuit*. Amadeus VIII. changed the image of St. Maurice, patron of Savoy, which hung at the collar, for that of the Virgin Mary; and instead of the motto above mentioned, substituted the words of the angel's salutation.

ANOIYMPIADES. See OLYMPIAD.

ANSPEADE. See LANCE CORPORAL.

ANTEMURALE, in the ancient military art, denotes much the same with that the moderns call the outworks.

ANTESTATURE, in ancient fortification, signifies an intrenchment of palisades or sacks of earth, thrown up in order to dispute the remainder of a piece of ground.

ANTHONY, or *Knights of St. Anthony*, a military order instituted by Albert, duke of Bavaria, Holland, and Zeland, when he designed to make war against the Turks in 1382. The knights wore a collar of gold made in the form of a hermit's girdle, from which hung a stick like a crutch, with a little bell, as they are represented in St. Anthony's pictures.

APPAREILLE, are those slopes that lead to the platform of the bastion. See FORTIFICATION.

APPAREILLES, are easy ascents leading to the works, or platforms, of a fortification.

APPOINTE, a foot soldier, who, for his long service and extraordinary bravery, receives pay above the private sentinels, and expects to be advanced. This is in France only.

APPOINTMENT, in a military sense, is the pay of the army; likewise applied to warlike habiliments, accoutrements, &c.

APPROACHES. All the works are generally so called that are carried on towards a place that is besieged; such as the first, second, and third parallels, the trenches, epaulements with and without trenches, redouts, places of arms, faps,

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saps, galleries, and lodgments. See these words more particularly at the word FORTIFICATION.

This is the most difficult part of a siege, and where most lives are lost. The ground is disputed inch by inch, and neither gained nor maintained without the loss of men. It is of the utmost importance to make your approaches with great caution, and to secure them as much as possible, that you may not throw away the lives of your soldiers. The besieged neglect nothing to hinder the approaches; the besiegers do every thing to carry them on; and on this depends the taking or defence of the place.

The trenches being carried to their glacis, you attack and make yourself master of their covered-way, make a lodgement on the counterscarp, and a breach by the sap, or by mines with several chambers, which blow up their intrenchments and fougades, or small mines, if they have any.

You cover yourselves with gabions, fascines, barrels, or sacks; and if these are wanting, you sink a trench.

You open the counterscarp by saps to make yourself master of it; but, before you open it, you must mine the flanks that defend it. The best attack of the place is the face of the bastion, when by its regularity it permits a regular approach and attacks according to art. If the place be irregular, you must not observe regular approaches, but proceed according to the irregularity of it; observing to humour the ground, which permits you to attack it in such a manner at one place, as would be useless or dangerous at another; so that the engineer who directs the attack ought exactly to know the part he would attack, its proportions, its force, and solidity, in the most geometrical manner.

APPROACHES, in a more confined sense, signify attacks.

Counter APPROACHES, are such trenches as are carried on by the besieged, against those of the besiegers.

APRON, in *gunnery*, a square plate of lead that covers the vent of a cannon, to keep the charge dry, and the vent clean and open.

Their dimensions are as follow, viz. for a 42, 32, and a 24 pounder, 15 inches by 13; for an 18, 12, and a 9 pounder, 12 inches by 10; for a 6, 5½, 3, and 1½ pounder, 10 inches by 8. They are tied fast by two strings of white marline, the length of which, for a 42 to a 12 pounder inclusive, is 18 feet, 9 feet each string; for a 9 to 1½ pounder, 12 feet, 6 feet for each.

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AQUEDUCT, a channel to convey water from one place to another. The Romans had aqueducts which extended 100 miles. That of Louis XIV. near Maintenon, which carries the river Bute to Versailles, is 7000 toises long, &c.

ARAIGNEE, in *fortification*. See GALLERY.

ARCH, in *military architecture*, is a vault or concave building, in form of a curve, erected to support some heavy structure, or passage.

Triumphal ARCH, in *military history*, is a stately gate, generally of a semicircular form, adorned with sculpture, inscriptions, &c. erected in honour of those heroes who have deserved a triumph.

ARCHERY, is the art of shooting with a bow. Our ancestors were famous for being the best archers in Europe, and most of our victories in France were the purchase of the long-bow. The statutes made in 33 Hen. VIII. relative to this exercise, are worth perusal, and would afford noble hints towards rendering our militia invincible.

ARCHITECTURE, in a *military sense*, is the art of erecting all kinds of military edifices or buildings, whether for habitation or defence.

Military ARCHITECTURE, instructs us in the method of fortifying cities, sea-ports, camps, building powder magazines, barracks, &c. See FORTIFICATION.

Naval ARCHITECTURE, is the art of building the hull, or body of the ship, distinct from her machinery and furniture for sailing; and may properly be comprehended in three principal articles. 1. To give the ship such a figure, or outward form, as may be most suitable to the service for which she is intended. 2. To find the exact shape of the pieces of timber necessary to compose such a fabric. 3. To make convenient apartments for the artillery, ammunition, provisions and cargo; together with suitable accommodations for the officers and men.

ARCHITRAVE, the master beam, or chief supporter, in any part of a subterraneous fortification.

AREA, the superficial content of any rampart, or other work of a fortification.

ARM, in *geography*, denotes a branch of the sea, or of a river.

ARM is also used figuratively to denote power.

To ARM, to take arms, to be provided against an enemy, or casualty.

ARMADA, a Spanish term, signifying a fleet

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fleet of men of war, applied particularly to that great one fitted out by the Spaniards, with an intention to conquer this island in 1588.

ARMADILLA, a Spanish term, signifying a small squadron.

ARMATURA, in *ancient military history*, signifies the fixed and established military exercise of the Romans, nearly in the sense we use the word Exercise.

ARMED, in a general sense, denotes something provided with, or carrying arms.

An ARMED body of men, denotes a military detachment, provided with arms and ammunition, ready for an engagement.

ARMED, in the *sea language*. A cross-bar-shot is said to be armed, when some rope-yarn, or the like, is rolled about the end of the iron bar which runneth through the shot.

ARMED ship, is a vessel taken into the government's service, and equipped by them, in time of war, with artillery, ammunition, and warlike instruments: it is commanded by an officer who has the rank of master and commander in the navy, and upon the same establishment with sloops of war, having a lieutenant, master, purser, surgeon, &c.

ARMILUSTRIUM, in *Roman antiquity*, a feast held among the Roman generals, in which they sacrificed, armed, to the sound of trumpets, and other warlike instruments.

ARMISTICE, a temporary truce, or cessation of arms for a very short space of time only.

ARMORY, a warehouse of arms, or a place where the military habiliments are kept, to be ready for use.

ARMOUR, denotes all such habiliments as serve to defend the body from wounds, especially darts, a sword, a lance, &c. A complete suit of armour formerly consisted of a helmet, a shield, a cuirass, a coat of mail, a gantlet, &c. now almost universally laid aside.

ARMOUR-BEARER, he that carries the armour of another.

ARMOURER, a person who makes or deals in armour, or arms; also a person who keeps them clean.

ARMS, in general, all kinds of weapons, whether used for offence or defence. In a legal sense, arms may extend to any thing that a man wears for his own defence, or takes in his hand, and uses in anger, to strike, throw at, or wound another.

Bells of ARMS, a kind of tents, in the shape of a cone, where the company's arms are lodged in the field. They are generally painted with the colour of the facing of the regiment, and the king's arms in front.

Pass of ARMS, a kind of combat, when an-

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tiently one or more cavaliers undertook to defend a pass against all attacks.

Place of ARMS. See FORTIFICATION.

Stand of ARMS, a complete set of arms for one soldier.

ARMS, in *artillery*, are the two ends of an axletree. See AXLETREE, under the word CARRIAGE.

Fire-ARMS, are great guns, firelocks, carbines, guns and pistols; or any other machine discharged by inflamed powder.

ARMY, a large number of soldiers, consisting of artillery, foot, horse, dragoons, and hussars or light-horse, completely armed, and provided with engineers, a train of artillery, ammunition, provisions, commissariat, forage, &c. and under the command of one general, having lieutenant-generals, major-generals, brigadiers, colonels, lieutenant-colonels, majors, captains, and subalterns. An army is composed of brigades, regiments, battalions, and squadrons; and is generally divided into three or more corps, and formed into three lines; the first of which is called the front-line, a part of which forms the van-guard; the second, the main body; and the third, the rear-guard, or corps of reserve. The centre of each line is generally possessed by the foot; the cavalry form the right and left wings of each line; and sometimes a squadron of horse is posted in the intervals between the battalions. When an army is drawn up in order of battle, the horse are frequently placed at five feet from each other, and the foot at three. In each line the battalions are distant from each other about 180 feet, which is nearly equal to the extent of their front; and the same holds good of the squadrons, which are about 300 feet distant, the extent of their own front. These intervals are left for the squadrons and battalions of the second line to range themselves against the intervals of the first, that both may more readily march thro' those spaces to the enemy. The front line is generally about 300 feet from the centre line; and the centre line as much from the rear, or corps of reserve; that there may be sufficient room to rally when the squadrons or battalions are broken.

A naval or sea ARMY, is a number of ships of war, equipped and manned with sailors, mariners, and marines, under the command of an admiral, with the requisite inferior officers under him.

Flying ARMY, a strong body of horse and foot, commanded for the most part by a lieutenant-general, which is always in motion, both to cover its own garrisons, and to keep the army

army in continual alarm. It is also used for the ground on which such a body of men encamps.

Wings of an Army. See WINGS.

ARREARS, in *the army*, is the difference between the full pay and subsistence of each officer, which is always paid once a year by the agent. See PAY.

ARROW. See FORTIFICATION.

ARSENAL, in a large and well-fortified town, is a large and spacious building, in which are deposited all kinds of arms, and other warlike implements; such as cannon, mortars, howitzers, small arms, and every other kind of warlike engines and instruments of death, which should be kept clean, and in good and serviceable repair, under the direction of a store-keeper and artificers.

ARTICLES OF WAR, are those known rules and regulations for the better government of the army in the kingdoms of Great-Britain and Ireland, dominions beyond the seas, and foreign parts: they are in number 27, besides those for the administration of justice, which are 23, and the additional articles for the entry of commissions, effects of the dead, artillery, and the American troops.

ARTILLERY, in a *general sense*, signifies all sorts of great guns or cannon, mortars, howitzers, petards, and the like; together with all the apparatus and stores thereto belonging, which are not only taken into the field, but likewise to sieges, and made use of both to attack and defend fortified places. See ORDNANCE.

ARTILLERY, in a *particular sense*, signifies the science of artillery or gunnery, which art includes geometry, trigonometry, conic sections, laws of motion, mechanics, and projectiles.

Train of ARTILLERY, an unlimited number of pieces of ordnance; such as 24 pounders, 18 pounders, 12, 9, 6, and 3 pounders; mortars from 13 to 8 inches diameter; besides royals and cohorns; howitzers of every denomination, mounted on their proper carriages and beds, &c. Besides, to the train belongs a sufficient quantity of horses, spare carriages, spare mortar-beds, block-carriages, limbers, waggons for ammunition and stores, shells, round and grape shot, bullets, powder, cartridges, portfires, intrenching-tools, artificers tools, miners tools, gins, capstans, forges, small stores, laboratory-stores, pontoons, pontoon-carriages, with their requisites; tumbrels, aprons of lead, budge-barrels, chevaux de frize, pallisades, platforms, chandeliers, blinds, drag-ropes, flints, harness, powder-measures, fuze-engines, fuzes, tents, &c. The train of artillery is, or should be, divided into brigades, to which belong not only the officers of the regiments of artillery,

but even the civil-list, such as comptrollers, commissaries of stores, clerks of stores, artificers of all denominations, conductors, store-keepers, waggon-masters, drivers, &c. The increase of artillery clearly demonstrates its great utility; for in the year 1520, an army of 50,000 men had only 40 pieces of cannon in the field; and in the year 1757, the same number of troops brought 200 pieces into the field, including mortars and howitzers.

Brigade of ARTILLERY, generally consists of 8 or 10 pieces of cannon, with all the machinery, and officers to conduct them, and all the apparatus thereto belonging.

ARTILLERY-Park, is that place appointed by the general of the army, to incamp the train of artillery, apparatus, ammunition, as well as the battalions of the artillery, appointed for its service and defence. The figure of the park of artillery, is that of a parallelogram, unless the situation of the ground renders another necessary.

The park of artillery is generally placed in the centre of the second line of incampment, and sometimes in the rear line, or corps of reserve. In both places the muzzles of the guns are in a line with the fronts of the sergeants tents of the regiments of artillery and infantry. Some generals chuse to place the park about 300 paces before the centre of the front line of the army. But let the situation be where it will, the manner of forming the park is almost every where the same, except that some artillery officers differ in the disposition of the carriages; others again divide the equipage as well as the guns into brigades, placing the first in the front line, the second in the next, and so on. However, the best, in my humble opinion, and the most approved method, is to divide the whole into brigades, placing the guns of the first to the right of the front line, and their ammunition behind them, in one or more lines; and the different brigades to be all numbered, with every waggon thereto belonging. Example, 1st brigade, front line, No. 1, 2, &c. 1st brigade, 2d line, No. 1, 2, &c. 2d brigade, front line, No. 1, 2, &c. and so of all the rest. This method will prevent confusion in forming and breaking up of the park, as also on a march: besides, according to the numbers, the stores therein contained are known.

Plate II. is the plan of such a park of artillery, as is customary in the Prussian army; consisting in 80 cannon, 20 mortars, 20 howitzers, 20 pontoons, 3 forges, and 433 waggons, with 2595 horses, and 649 drivers, ranged as follows.

First

First line, 20 six-pounders, 20 twelve pounders, 20 six-pounders; 60 in all.

Second line, 2 spare carriages, 18 waggons with balls and cartridges, 4 carriages, 32 waggons with balls, 4 carriages, 17 waggons with balls, 3 carriages; 80 in all.

Third line, 5 spare carriages, 33 waggons with balls, 3 ditto with port-fires and matches, 32 ditto with cartridges and grape-shot, 6 carriages; in all 79.

Fourth line, 20 howitzers, 40 waggons with shells, fuzes fixed, 20 mortars; in all 80.

Fifth line, 4 carriages, 12 powder carts, 2 waggons with howitzer grape-shot, 40 ditto with grenades, 18 ditto with musket-balls; in all 76.

Sixth line, 80 waggons with musket-cartridges.

Seventh line, 24 waggons with intrenching tools, 20 pontoons with the requisites for forming bridges, 2 waggons with extraordinaries for ditto, 20 ditto with musket-cartridges, 4 ditto with artificers tools, 3 forges, 7 spare waggons; in all 80. Each carriage takes up 6 feet, and they are placed at the same distance from each other in the lines, which makes room sufficient for loading or unloading them. The second line is 90 feet behind the first; all the rest are 60 feet from each other.

Under the term *Artillery-park*, is to be considered the method of incampment for the regiments of artillery, and every thing thereto belonging, which is as follows, viz.

Incampment of a regiment of ARTILLERY: they are always incamped, half on the right, and half on the left of the park. The company of bombardiers (when formed into companies, which is in almost every nation excepting England) always takes the right of the whole, and the lieutenant-colonels company the left; next to the bombardiers, the colonels, the majors, &c. so that the two youngest are next but one to the centre or park: the two companies next to the park, are the miners on the right, and the artificers on the left. See PLATE II.

In the rear of, and 30 feet from the park, are incamped the civil list, all in one line.

The breadth between the front tent-pole of one company, and that of another, called the streets, are 36 feet each.

FEET

From the front pole of officers tent of the quarter-guard, or guard of the army, to the centre of the bells of arms of ditto, is

24

To the parade of the quarter-guard

12

To the first line of the regimental parade

150

To the centre of the bells of arms	90
From thence to the front poles of serjeants tents	12
For pitching 12 tents of artillery, with their proper intervals, at 9 feet each	108
From the rear of companies tents, to the front of the subalterns tents	60
From the front of the subalterns, to that of the captains	72
From the front of the captains, to that of the field officers	72
From the front of the field officers, to that of the colonels	36
From the front of the colonels, to that of the staff officers	48
From the front of the staff officers, to the front row of batmans tents	54
From thence to the first row of pickets for horses	6
From thence to the second row	36
From thence to the second row of batmans tents	6
From thence to the front of the grand sutler's tent	42
From thence to the centre of the kitchens	60
From thence to the front of petit-sutler's tents	45
From thence to the centre of the bells of arms of the rear-guard	45

Total depth 978

The army-guard is in the front of the park, opposite the alarm-guns, in a line with the artillery quarter-guards that are placed on the right and left of the artillery companies.

The bells of arms front the poles of serjeants tents.

The colours are placed in the centre of the front line of guns, in the interval of the two alarm-guns, in a line with the bells of arms of the companies.

The lieutenant-colonels and majors tents front the centres of the second streets from the right and left of the regiment.

The colonel's tent is in a line with the colours and guard of the army, facing the same.

The staff-officers front the centres of the second streets, on the right and left of the angles of the park.

The batmans tents front towards their horses.

The rear-guard front outwards. The front-poles are in a line with the centre of their bells of arms, and each 18 feet distant. The parade of

of the rear-guard is 12 feet from the bells of arms.

In the rear of the rear-guard, and 80 feet distance from their parade, the artillery-horses and drivers tents are placed, in two or more lines, parallel with the line of guns, extending from the right and left of the whole.

It sometimes happens that a very large train of artillery is in the field, with two or more regiments: then the oldest takes the right of the park; the next oldest the left, and the youngest the centre: then the centre or grand street is 63 feet broad, opposite which the tent of the commanding-officer is placed. In the centre of this street, the colours are placed in a line with the bells of arms, and the artillery quarter-guard in the front of the colours, at the same distance as before mentioned. See PLATE II.

Regiment of ARTILLERY. The corps of artillery, with all its dependencies, is, as it were, the general instrument of the army, and without it nothing can be done. It is impossible to attack fortified places, or to defend them,

without artillery; and an army in the field, without, can never make head against one well provided with it. For this reason it is, that at all times sovereigns have taken great care to provide proper officers of learning and capacity to govern, repair and keep in order, this essential part of military force.

The strength of a regiment of artillery depends upon the choice of the prince, the quantity of troops he maintains, and more especially on the situation of the country, number of fortifications, and foreign establishments to be defended. It has always been a prevailing custom, to regulate the corps of artillery according to the French method; but, since the famous present king of Prussia has fixed his regiments of artillery on quite another plan, we chuse here first to explain our own method, and afterwards that of the king of Prussia, and to let the candid reader judge for himself, which method is the best.

English ARTILLERY, in the reign of Edward VI. and about the year 1548, consisted in the following establishment, viz.

			£.	s.	d.	£.	s.	d.
Master of Artillery,	Sir Philip Hoby,	} Fee	0	0	0	151	11	8
Lieutenant,	Sir Francis Fleming,		0	0	0	66	13	4
Surveyor,	Anthony Anthony,		0	0	0	36	10	0
Clerk, John Rogers,	. . . . .	{ Fee	0	0	0	12	3	4
		{ In room of a fervant	0	0	0	12	3	4
Yeoman, Thomas Sheventon	. . . . .	{ Fee	0	0	0	9	2	6
		{ In room of a fervant	0	0	0	18	5	0
Master Gunner,	Christian Gold,	} Fee	0	1	0	18	5	0
Gun-stock Maker,	Symond Turner,		0	0	6	9	2	6
Gun-founders	{ John Owen,		0	0	8	12	3	4
	{ Thomas Owen,		0	0	8	12	3	4
Gun-smith,	John Anthony		0	0	6	9	2	6
Artificer, or Engineer,	John Pudney,		0	0	4	6	1	8
Master Carpenter,	John Johnson,		0	0	8	12	3	4
109 Gunners,	{ 15 } at { 12d } a day each.	{ }	0	15	0	273	15	0
			0	8	0	146	0	0
			2	0	0	730	0	0
			0	0	8	12	3	4
whereof	{ 12 } { 8d } { }							
	{ 80 } { 6d } { }							
	{ 2 } { 4d } { }							
Total charges of the artillery for one year						1547	9	2

In the 109 gunners above mentioned, are included fees to the following persons, viz.

To the {	Clerk, John Rogers,	} at {	8d	} a day.
	Master-gunner,		12d	
	Yeoman		12d	
To John Owen, Gun-founder,			12d	

So that only 105 effective gunners remain.

The establishment of artillery in the reign of queen Elizabeth, especially in the year 1597, is as follows, viz.

Allowances to officers within one quarter, ending the last of March, 1597, viz.

To Sir George Carew, knight, lieutenant of her Majesty's ordnance, for his allowance one quarter. £. xviii

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To William Parkeringe, surveyor of her majesty's ordnance, for his like quarter's allowance	£.	xviii	
To Stephen Riddlefden, clerk of her majesty's ordnance, for his like quarter's allowance,		xvii	xii
To John Lee, keeper of her majesty's stores, ditto		x	
To George Hogge, and John Linewrayce, clerks of the deliveries, ditto		xiii	xi iiiii
To William Cudner, clerk to Sir George Carew, knight, ditto		iiii	xi ii
Clerks daily attending in the said office, for three months, viz.			

Richard Palfreyman,	.	.	.	.	.	£.
Edward Parkeringe,	.	.	.	.	.	v	
William Scott,	.	.	.	.	.	v	
Richard Haynes	.	.	.	.	.	v	
Thomas Lemmon	.	.	.	.	.	v	
John Squire	.	.	.	.	.	v	
Richard Lentall,	.	.	.	.	.	v	
							xxxv

£. vxviii xvii vi

That is £518 17 6 for one quarter's salary.

These two last accounts are taken from a manuscript of the late Rev. William Gostling's, and very obligingly communicated to me by capt. William Gostling, of the royal artillery.

The establishment of artillery in the reign of James I. and in the year 1618, is as follows, viz.

- 1 General of artillery.
- 1 Lieutenant of artillery.
- 1 Comptroller.
- 1 Commissary.
- 10 Gentlemen } of artillery.
- 25 Conductors }
- 6 Engineers.
- 2 Comptrollers of fortifications.
- 1 Master gunner.
- 136 Gunners.
- 1 Master fire-worker.
- 2 Conductors of fire-works.
- 2 Battery-masters.
- 1 Petardier.
- 1 Master carpenter.
- 12 Carpenters.
- 2 Waggon } makers.
- 2 Gabion }
- 2 Harness }
- 1 Cooper.
- 2 Farriers.
- 1 Surgeon.
- 1 Surgeon's mate.
- 1 Captain of miners.
- 15 Miners.
- 1 Captain of pioneers.
- 25 Pioneers.
- 1 Trench } master.
- 1 Waggon }
- 1 Carriage }
- 1 Provost.

In 1628, and probably long before, the artillery had sundry privileges, from which the rest of the army were exempt, viz. of having the first rank and the best quarters; neither could any carriage or waggon presume to march before theirs, except that belonging to the treasurer.

In 1705, I find the first mention is made of the royal regiment of artillery, being before that time only called the train of artillery. It then consisted only of 4 companies, under the command of general Borgard. From that period it has gradually increased to 4 battalions, each battalion consisting of 10 companies, (2 of them invalids) commanded by a colonel commandant, a lieutenant-colonel and major, who have no companies. Each company in war time generally consists of 100 men, commanded by 1 captain, 1 captain lieutenant, 1 first, and 3 second lieutenants. In time of peace the companies are reduced to 50 men each.

When Frederick the second, king of Prussia, came to the crown, he found the army in a very good condition, excepting the corps of artillery and engineers, which consisted chiefly in mechanicks and artisans, scarcely looked on by the rest of the army and the officers without commissions. His majesty, knowing how necessary it was to have a good corps of artillery and engineers, and how impossible this was without having officers learned in every branch of the military mathematics; he immediately draughted all the illiterate officers into the garrison regiments, supplying their places with gentlemen of examined capacity; gave them all commissions, rank with the officers of the guards, and an extraordinary pay. This method of proceeding established the honour and

and reputation of that royal and noble corps, on a very respectable footing; induced the nobility and men of rank (provided they had capacity) to engage in those corps sooner than elsewhere; which has brought it to that summit of high renown, they at this time enjoy.

The Prussian artillery consists in 12 battalions, 8 for the field, and 4 for garrison. Each battalion has 12 companies, namely, 1 company of bombardiers, 1 of miners, 1 of artificers, and 9 of artillery. The first, or bombardier companies, are composed of 1 captain, 2 lieutenants, 3 upper and 6 under fire-workers, 2 serjeants, 4 corporals, 2 drummers, and 60 bombardiers. The miners have the same commissioned officers, with 3 serjeants, 6 corporals, 2 drummers, 33 miners, and 33 sappers. The artificers have the same officers and non-commissioned officers as the miners, with 30 artificers and 36 pontoneers. All the artillery companies have 3 commissioned and 6 non-commissioned officers, 2 drummers, and 60 artillerists. The colonel, lieutenant-colonel, and major's companies, have each a captain-lieutenant; and each battalion has further, 1 chaplain, 1 auditor, 1 adjutant, 1 quarter-master, 1 doctor, 3 surgeons, 1 serjeant-major, 1 drum-major, 6 musicians, and 1 provost.

March of the ARTILLERY. The marches of the artillery are, of all the operations of war, the most delicate; because they must not only be directed on the object you have in view, but according to the movements the enemy make. Armies generally march in 3 columns, the centre column of which is the artillery: should the army march in more columns, the artillery and heavy baggage march nevertheless in one or more of the centre columns; the situation of the enemy determines this. If they are far from the enemy, the baggage and ammunition go before or behind, or are sent by a particular road; an army in such a case cannot march in too many columns. But should the march be towards the enemy, the baggage must absolutely be all in the rear, and the whole artillery form the centre column, except some brigades, one of which marches at the head of each column, with guns loaded and burning matches, preceded by a detachment for their safety.

Suppose the enemy's army in a condition to march towards the heads of your columns: the best disposition for the march is in 3 columns only; that of the centre for the artillery; for it is then easy to form them in order of battle. Hence it is equally commodious for

each brigade of artillery to plant themselves at the head of the troops, in the places marked for them, in such a manner that the whole disposition being understood, and well executed, they may form quickly in order of battle in an open country, and in the presence of any enemy, without risking any surprize; by which method the artillery will always be in a condition to act as soon as the troops, provided they march in brigades.

Is your march through a country full of defiles, some dragoons should march at the head of the columns, followed by a detachment of grenadiers, and a brigade of artillery; cannon being absolutely necessary to obstruct the enemy's forming into order of battle.

When you decamp in the face of the enemy, you must give most attention to your rear-guard. On such occasions, all the baggage, ammunition, provisions, and artillery, march before the troops; your best grenadiers, best cavalry, some good brigades of infantry, together with some brigades of artillery, form the rear-guard. Cannon is of infinite use for a rear-guard, when obliged to pass a defile, or a river; and should be placed at the entry of such defile, on an eminence, if there is one, or on any other place, from whence they can discover the ground through which the enemy must march to attack the rear-guard.

A detachment of pioneers, with tools, must always march at the head of the artillery, and of each column of equipage or baggage.

If the enemy is encamped on the right flanks of the march, the artillery, &c. should march to the left of the troops, and vice versa. Should the enemy appear in motion, the troops front that way, by wheeling to the right or left by divisions; and the artillery, which march in a line with the columns, pass through their intervals, and form at the head of the front line, which is formed of the column who flanked nearest the enemy, taking care at the same time that the baggage be well covered during the action.

Though we have said armies generally march in 3 columns, yet where the country will allow it, it is better to march in a greater number; and let that number be what it will, the artillery must form the centre columns.

Line of march of the ARTILLERY. 1. A guard of the army; its strength depends on the commander in chief.

2. The companies of miners (excepting a detachment from each, dispersed in various places, to mend the roads) with tumbrils of tools, drawn by 2 horses, assisted by pioneers.

3. The

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3. The brigades of artillery's front guard, with four light 6 pounders loaded, and matches burning.

4. The kettle-drums by 4 horses, and 2 trumpeters on horse-back.

5. The flag-gun, drawn by 12 horses, and ten 12 pounders more, by 4 horses each.

6. Twenty waggons with stores for the said guns, and 1 spare one, by 4 horses each.

7. All the pontoons, with the waggons thereto belonging.

8. Eight 9 pounders, by 3 horses each.

9. Fifteen waggons with stores for said guns, by 4 horses each, and 2 spare ones.

10. Guns and capstans, with their proper workmen, 3 waggons, with 2 horses each.

11. A forge on 4 wheels, and 1 waggon, 4 horses each.

12. Twelve heavy 24 pounders, by 16 horses each.

13. Sixteen waggons with stores for ditto, and 2 spare ones, by 4 horses each.

14. A waggon with tools, and pioneers to mend the roads.

15. Nine light 24 pounders, by 8 horses each.

16. Twelve waggons with stores for ditto, and 2 spare ones, by 4 horses each.

17. A forge and waggon, by 4 } horses each

18. Nine 24 pounders, by 8 }

19. Twelve waggons with stores for ditto, and 2 spare ones.

20. Twelve 12 pounders, by 8 horses each.

21. Sixteen waggons with stores for ditto, and 2 spare ones.

22. Sixteen 5.8 inch mortars, by 2 horses each.

23. Twenty-five waggons with stores for ditto, and 2 spare ones.

24. Ten 8 inch mortars, by 4 horses each.

25. Twenty waggons with stores for ditto, and 2 spare ones.

26. Six 10-inch howitzers, by 6 horses each.

27. Twenty waggons with stores for ditto, and 2 spare ones.

28. A waggon with tools, and men to mend the roads.

29. A forge and waggon, by 4 horses each.

30. Ten 8-inch mortars, by 4 horses each.

31. Twenty waggons with stores for ditto, and a spare one.

32. Sixteen 12-inch mortars, by 8 horses each.

33. Thirty waggons with stores for ditto, and 2 spare ones.

34. Eight 18-inch stone mortars, by 10 horses each.

35. Sixteen waggons with stores for ditto, and a spare one.

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36. Eight 9-pounders, by 3 horses each.

37. Sixteen waggons, with stores for ditto, and a spare one.

38. Twenty 6-pounders, by 2 horses each.

39. Twenty waggons, with stores for ditto, and a spare one.

40. Two sling-waggons, and 2 truck-carriages, 4 horses each.

41. Twenty 3-pounders, by one horse each.

42. Ten waggons, with stores for ditto, and a spare one.

43. A waggon, with tools, &c.

44. A forge and waggon, by 4 horses each.

45. Twelve 2 and 1-pounders, by 1 horse each.

46. Six waggons, with stores for ditto.

47. Sixteen 6-pounders, by 2 horses each.

48. Ten waggons, with stores for ditto.

49. Twenty spare carriages, for various calibres.

50. Eighteen ditto.

51. Fifty spare limbers.

52. Ten 18-pounders, by 6 horses each.

53. Twenty waggons, with stores for ditto, and 2 spare ones.

54. Twenty waggons, with ammunition and stores.

55. Two 12-pounders, by 4 horses each.

56. Four waggons, with stores for ditto.

57. Fifty waggons, with stores.

58. A waggon, with tools, and men to mend the roads.

59. A forge and waggon, by 4 horses each.

60. A hundred waggons, with stores, and 4 spare ones.

61. Four 2 and 1-pounders, by 1 horse each.

62. A hundred waggons, with stores, and 3 spare ones.

63. Two hundred waggons, and 2 spare ones.

64. Two hundred and fourteen waggons belonging to the artillery baggage; some with 4, 3, and 2 horses each.

65. The artillery rear-guard.

66. The rear-guard from the army.

Officers of ARTILLERY. The commander in chief of the artillery is one of the most laborious employments, both in war and peace, requiring the greatest ability, application, and experience. The officers in general should be great mathematicians and engineers, to know all the powers of artillery, the attack and defence of fortified places; together with every thing belonging to that very important corps.

ARTILLERY

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ARTILLERY Company, a band of infantry, consisting of 600 men, making part of the militia, or city guard of London.

ASCENT. See **GUNNERY**.

ASSAULT, a furious effort to carry a fortified post, camp, or fortress, where the assailants do not screen themselves by any works. While an assault during a siege continues, the batteries cease, for fear of killing their own men. An assault is sometimes made by the regiments that guard the trenches of a siege, sustained by detachments from the army.

To give an ASSAULT, is to attack any post, &c.

To repulse an ASSAULT, to cause the assailants to retreat, to beat them back.

To carry by ASSAULT, to gain a post by storm, &c.

ASSEMBLE, the second beating of a drum before a march; at which the army strike their tents, roll them up, and stand to arms. See **DRUM**.

ASTRAGAL. See **CANNON**.

ATTACK, a general assault, or onset, that is given to gain a post, or break a body of troops.

Attack of a siege, is a furious assault made by the besiegers by means of trenches, galleries, saps, breaches, or mines, &c. by storming

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any part of the front attack. Sometimes two attacks are carried on at the same time, between which a communication must be made. See **SIEGE**.

False ATTACKS, are never carried on with that vigour and briskness that the others are the design of them being to favour the true attack, by amusing the enemy, obliging the garrison to a greater duty in dividing their force, that the true attack may be more successful.

Regular ATTACK, is that which is carried on in form, according to the rules of art. See **SIEGE**.

To ATTACK in front or flank, in fortification, is meant to attack the salient angle, or both sides of the bastion; but when meant to attack a body of men, is a phrase well known.

AVANT-FOSSÉ. See **FORTIFICATION**.

AVENUE, in fortification, is any kind of opening or inlet into a fort, bastion, or out-work.

AUGERS. See **MINING**.

AUGMENT, or *Augmentation*, in a military sense, implies advancement of posts, augmentation of troops, &c.

AXLE-TREE	{	of a carriage.	{	See Carriages.
		bar.		
		bolts.		
		hoops.		
		stays.		

B

BACUL, in fortification, implies a kind of port-cullis or gate, made like a pit-fall, with a counterpoise, and supported by two strong pieces of timber. It is usually placed before the corps de garde, not far from the great gate of the place.

BAGGAGE, in military affairs, signifies the clothes, tents, utensils of divers sorts, and provisions, &c. belonging to an army.

BAGGAGE-Waggons. See **WAGGONS**.

BAGONET. See **BAYONET**.

BAGPIPE, the name of a well-known warlike instrument, of the wind kind, greatly used by the Scotch regiments, and sometimes by the Irish. Bagpipes are supposed to be introduced by the Danes; but I am of opinion they are much older, as there is in Rome a most beautiful bas-relievo, a Grecian sculpture of the highest antiquity, of a bag-piper playing on his instrument exactly like a modern highlander. The Greeks had their *Ασκαυλη*, or instrument composed of a pipe and blown-up skin. The Romans, in all probability, borrowed it from them, who still use it under the names of *piva* and *cornu-musa*. The Bagpipe has been a favourite instrument of the Scots, and has two varieties: the one with long pipes, and sounded with the mouth; the other with short pipes,

played on with the fingers: the first is the loudest and most ear-piercing of all music, is the genuine highland pipe, and suited well the warlike genius of that people, roused their courage to battle, alarmed them when secure, and collected them when scattered; soled them in their long and painful marches, and in times of peace kept up the memory of the gallantry of their ancestors, by tunes composed after signal victories.

BAGS, in military employments, are used on many occasions: as,

Sand-BAGS, generally 16 inches diameter, and 30 high, filled with earth or sand to repair breaches, and the embrasures of batteries, when damaged by the enemies fire, or by the blast of the guns. Sometimes they are made lels, and placed three together, upon the parapets, for the men to fire through.

Earth-BAGS, containing about a cubical foot of earth, used to raise a parapet in haste, or repair one that is beaten down. They are only used when the ground is rocky, and not affording earth to carry on the approaches.

BALL, in the military art, comprehends all sorts of balls and bullets for fire-arms, from the cannon to the pistol.

Cannon-BALLS are of iron; musket and
D pistol-

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pistol-balls are of lead. Cannon-balls are always distinguished by their respective calibres, thus,

A 42	} pound ball, the diameter of which is	{ 6,684 inches
32		{ 6,105
24		{ 5,547
18		{ 5,040
12		{ 4,403
9		{ 4,000
6		{ 3,498
3		{ 2,775
2		{ 2,423
1		{ 1,923

Fire-BALLS, of which there are various

Light-BALLS, for forts, and for various purposes. Their composition is mealed powder 2, saltpetre 1½, sulphur 1, rosin 1, turpentine 2½. Sometimes they are made of an iron shell, sometimes a stone, filled and covered with various coats of the above composition, 'till of a proper size; letting the last coat be of grained powder. But the best sort, in my opinion, is to take thick brown paper, and make a shell the size of the mortar, and fill it with a composition of an equal quantity of sulphur, pitch, rosin, and mealed powder; which being well mixed, and put in warm, will give a clear fire, and burn a considerable time.

When they are intended to set fire to magazines, buildings, &c. the composition must be mealed powder 10, saltpetre 2, sulphur 4, and rosin 1; or rather mealed powder 48, saltpetre 32, sulphur 16, rosin 4, steel or iron filings 2, fir-tree saw-dust boiled in saltpetre ley 2, birch-wood charcoal 1, well rammed into a shell for that purpose, having various holes filled with small barrels, loaded with musket-balls; and lastly the whole emerged in melted pitch, rosin and turpentine oil.

Smoke-BALLS are prepared as above, with this difference, of 5 to 1 of pitch, rosin and saw-dust. This composition is put into shells made for that purpose, having 4 holes to let out the smoke: they are thrown out of mortars, and continue to smoke from 25 to 30 minutes.

Stink-BALLS are prepared by a composition of mealed powder, rosin, saltpetre, pitch, sulphur, rased bones and asses hoofs, burnt in the fire, assa-fœtida, seraphim-gum or ferula, and bug or stinking herbs, made up into balls, as mentioned at *Light-BALLS*, agreeable to the size of the mortar you intend to throw them out of.

Poisoned-BALLS. I am not sure whether ever they have been used in Europe, but the Indians and Africans have always been very ingenious at poisoning several sorts of warlike stores and instruments. Their composition is

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mealed powder 4, pitch 6, rosin 3, sulphur 5, assa-fœtida 8, extract of toads poison 12, other poisonous substances 12, made into balls as above directed.

Red-hot BALLS are fired out of mortars, howitzers, or cannon. Use which you will, the ball must be made red-hot, which is done upon a large coal fire in a square hole made in the ground, 6 feet every way, and 4 or 5 feet deep. Some make the fire under an iron grate, on which the shell or ball is laid; but the best way is to put the ball into the middle of a clear burning fire, and when red-hot, all the fiery particles must be swept off. Whatever you use to throw the red-hot ball out of, must be elevated according to the distance you intend it shall range, and the charge of powder put into a flannel cartridge, and a good wad upon that; then a piece of wood of the exact diameter of the piece, and about 3½ inches thick, to prevent the ball from setting fire to the powder; then place the ball on the edge of the mortar, &c. with an instrument for that purpose, and let it roll of itself against the wood, and instantly fire it off. Should there be a ditch or parallel before such a battery, with soldiers, the wood must not be used, as the blast of powder will break it to pieces, and its own elasticity prevent it from flying far; it would in that case either kill or wound your own people. For this deficiency the wad must be double.

Chain-BALLS are two balls linked together by a chain of 8 or 10 inches long, and I have even seen some with a chain of 3 or 4 feet long; they are used to destroy the palisadoes, wooden bridges, and chevaux-de-frizes of a fortification. They are also very destructive to the rigging of a ship.

Stang-BALLS are by some called balls of two heads; they are sometimes made of two half-balls joined together by a bar of iron from 8 to 14 inches long; they are sometimes made of two entire balls: they are for the same purpose as the before-mentioned.

Anchor-BALLS are made in the same way as the light-balls, and filled with the same composition, only with this addition, that these are made with an iron bar of ¾ of the ball's diameter in length, and 3 or 4 inches square. One half is fixed within the ball, and the other half remains without; the end of the out half is made with a grapple-hook. Very useful to set fire to wooden bridges, or any thing made of wood, or even the rigging of ships, &c. for the pile-end being the heaviest, lies foremost, and wherever it touches, fastens, and sets all on fire about it.

Message-BALLS. See SHELLS.

BALLIUM, in *ancient military history*. In towns the appellation of ballium was given to a work fenced with pallisades, and sometimes masonry, covering the suburbs; but in castles it was the space immediately within the outer wall.

BAN, a sort of proclamation made at the head of a body of troops, or in the several quarters or cantonments of an army, by sound of trumpet, or beat of drum; either for observing of martial discipline, or for declaring a new officer, or punishing a soldier, or the like. At present such kind of proclamations are given out in the written orders of the day.

BANDOLIEFERS, in *ancient military history*, a large leathern belt worn over the right shoulder, and hanging under the left arm, to carry some kind of warlike weapon.

BANDOLLERS, are little wooden cases covered with leather, of which every musketeer used to wear 12 hanging on a shoulder-belt; each of them contained the charge of powder for a musket. They are now no more in use, but are still to be seen in the small-armory in the Tower.

BANDROLLS. See CAMP COLOURS.

BANDS, properly bodies of foot, though almost out of date.

Trained-BANDS. In England the militia are generally so called.

BAND of Pensioners, a company of gentlemen so called, who attend the King's person upon all solemn occasions. They are 120 in number, and receive a yearly allowance of 100l.

BAND is also the denomination of a military order in Spain, instituted by Alphonfus XI. king of Castile, for the younger sons of the nobility, who, before their admission, must serve 10 years, at least, either in the army or at war; and are bound to take up arms in defence of the Catholic faith, against the infidels.

BANQUETTE. See FORTIFICATION.

BANNERS, the ordnance-flag fixed on the fore part of the drum-major's kettle-drum carriage of the royal artillery.

BARBACAN, or *Barbican*, a watch-tower, for the purpose of deservying an enemy at a great distance: it also implies an outer defence, or sort of ancient fortification to a city or castle, used especially as a fence to the city, or walls; also an aperture made in the walls of a fortress to fire through upon the enemy. It is sometimes used to denote a fort at the entrance of a bridge, or the outlet of a city, having a double wall with towers.

BARBICANAGE, money given to the maintenance of a Barbican.

BARBE. See BARBET.

BARBETS, are peasants subject to the king of Sardinia, who abandon their dwellings, when the enemy has taken possession of them. The king forms them into bodies, who defend the Alps, being part of his dominions.

BARBET-Battery. See BATTERY.

BARM, or *Berm*. See FORTIFICATION.

BARS are of sundry sort, as

Sweep } **BARS.** See TUMERIL
Cross }

Tree }
Hind } **Cross-BARS.** See POWDER-CART
Under }

Shaft } **BARS.** See { WAGGON.
Drivel } { MORTAR BED.

BARRACKS, or *Baracks*, are places erected for both officers and men to lodge in: they are built different ways, according to their different situations. When there is sufficient room to make a large square, surrounded with buildings, they are very convenient, because the soldiers are easily confined to their quarters, and the rooms being contiguous, orders are executed with privacy and expedition; and the soldiers have not the least connection with the inhabitants of the place, which prevents quarrels and riots. The barracks at Woolwich are 16 feet square, and 3 beds in each room to hold 6 soldiers only, which is not sufficient. They would be much better if they were 20 feet long, and 18 broad, and hold 4 beds. They are sometimes built 2 or 3 stories high.

BARRICADE. To barricade is to fortify with trees, or branches of trees, cut down for that purpose, the brushy ends towards the enemy. Carts, waggons, &c. are sometimes made use of for the same purpose, viz. to keep back both horse and foot for some time.

BARRELS, in military affairs, are of various kinds.

Fire-BARRELS are of different sorts: some are mounted on wheels, filled with composition and intermixed with loaded grenades, and the outside full of sharp spikes: some are placed under ground, which have the effect of small mines: they are used to roll down a breach, to prevent the enemy's entrance.—Composition, corned powder 30 lb. Swedish pitch 12, saltpetre 6, and tallow 3.

Thundering-BARRELS are for the same purpose, filled with various kinds of combustibles, intermixed with small shells, grenades, and other fireworks.—Not used now.

Powder-BARRELS are about 16 inches diameter, and 30 or 32 inches long, holding 100 pounds of powder.

Budge-BARRELS, hold from 40 to 60 pounds of powder: at one end is fixed a leather bag

B A R

with brags nails: they are used in actual service on the batteries, to keep the powder from firing by accident, for loading the guns and mortars.

BARRIER, in *fortification*, a kind of fence composed of stakes, and transoms, as overthwart rafters, erected to defend the entrance of a passage, retrenchment, or the like. In the middle of the barrier is a moveable bar of wood, which is opened and shut at pleasure. It also implies a gate made of wooden bars, about 5 feet long, perpendicular to the horizon, and kept together by two long bars going across, and another crossing diagonally: they are used to stop the cut made through the esplanade before the gate of a town.

BARRIER-TOWNS, in *military history*, are Menin, Dendermond, Ypres, Tournay, Mons, Namur, and Maltricht. These towns are garrisoned half by French or Imperial, and half by Dutch troops.

BASE, or *Basis*, in *fortification*, the exterior part or side of a polygon, or that imaginary line which is drawn from the flanked angle of a bastion to the angle opposite to it.

BASE signifies also the level line on which any work stands that is even with the ground, or other work on which it is erected. Hence the base of a parapet is the rampart.

BASE, an ancient word for the smallest cannon. See **CANNON**.

BASE-RING. See **CANNON**.

BASILISK, an ancient name given to a 48 pounder. See **CANNON**.

BASIS, the same as **BASE**.

BASKETS, in *military affairs*, are simple baskets, frequently used in sieges. They are filled with earth, and placed on the parapet of the trench, or any other part. They are generally about a foot and a half in diameter at the top, and eight inches at the bottom, and a foot and a half in height; so that, being placed on the parapet, a kind of embrasures are formed at the bottom, through which the soldiers fire, without being exposed to the shot of the enemy.

BASTION. See **FORTIFICATION**.

BATARDEAU, in *fortification*, is a massive perpendicular pile of masonry, whose length is equal to the breadth of the ditch, inundation, or any part of a fortification where the water cannot be kept in without the raising of these sorts of works, which are described either on the capitals prolonged of the bastions or half-moons, or upon their faces. In thickness it is from 15 to 18 feet, that it may be able to withstand the violence of the

B A T

enemy's batteries. Its height depends upon the depth of the ditch, and upon the height of the water that is necessary to be kept up for an inundation; but the top of the building must always be under the cover of the parapet of the covert-way, so as not to be exposed to the enemy's view. In the middle of its length is raised a massive cylindrical turret, whose height exceeds the batardeau 6 feet.

Knights of the BATH, an English military order of uncertain original. Some writers say it was instituted in the Saxon times; some will have it to have been founded by Richard II. and others by Henry IV. nor is the occasion that gave rise to their order better known. Some say it arose from the custom which formerly prevailed of bathing, before they received the golden spurs. Others say that Henry IV. being in the bath, was told by a Knight, that two widows were come to demand justice of him; when leaping out of the bath, he cried, "It was his duty to prefer the doing of justice to his subjects to the pleasures of the bath;" and in memory of this transaction the Knights of the Bath were created. Camden however insists, that this was only the restoration of the order, which was in that prince's reign almost abolished: But however that be, the order was revived under George I. by a solemn creation of a considerable number of Knights. They wear a red ribbon, and their motto is, *Tres juncta in uno*, alluding to the three cardinal virtues which every Knight ought to possess.

BATMEN are servants hired in war time to take care of the horses belonging to the train of artillery, bakery, baggage, &c. They generally wear the king's livery during their service.

BATTALIA, in *military affairs*, implies an army or considerable detachment of troops drawn up in order of battle, or in any other proper form to attack the enemy. See **BATTLE**.

BATTALION, or *Battalion*, an undetermined body of infantry in regard to number, generally from 500 to 800 men. In our foot guards, the first regiment consists of 3 battalions, and the second and third of 2 each. The royal regiment of artillery consists of 4 battalions. Sometimes regiments consist of but 1 battalion; but if more numerous, are divided into several battalions, according to their strength; so that every one may come within the numbers mentioned. A battalion in one of our marching regiments consists of 603 men, officers and non-commissioned included. When there are companies of several regiments in a garrison to form a battalion, those of the eldest regiment post themselves on the right, those

those of the second on the left, and so on until the youngest fall into the centre. The officers take their posts before their companies, from the right and left, according to seniority. Each battalion is divided into 4 divisions, and each division forms 2 platoons. The companies of grenadiers being unequal in all battalions, their post should be regulated by the commanding officer. See REGIMENT.

Triangular BATTALION, in *ancient military history*, a body of troops ranged in the form of a triangle, in which the ranks exceed each other by an equal number of men: if the first rank consists of one man only, and the difference between the ranks is only one, then its form is that of an equilateral triangle; and when the difference between the ranks is more than one, its form may then be an isosceles, or scalene triangle. This method is now laid aside.

BATTERING, in *military affairs*, implies the firing with heavy artillery on some fortification or strong post possessed by an enemy, in order to demolish the works.

BATTERING-Pieces are large pieces of cannon, though they now never exceed a 24 pounder, used in battering a fortified town or post.

BATTERING-Train, a train of artillery used solely for besieging a strong place, inclusive of mortars and howitzers: all heavy 24, 18, and 12 pounders, come under this denomination; as likewise the 10 and 8-inch mortars and howitzers.

BATTLING-Ram. See the article RAM.

BATTERY, in *military affairs*, implies any place where cannon or mortars are mounted, either to attack the forces of the enemy, or batter a fortification: hence batteries have various names, agreeable to the purposes they are designed for.

Gun-BATTERY, is a defence made of earth faced with green sods or fascines, and sometimes made of gabions filled with earth: it consists of a *breast-work*, *parapet*, or *escarpment*, of 18 or 20 feet thick at top, and of 22 or 24 at the foundation; of a ditch 12 feet broad at the bottom, and 18 at the top, and 7 feet deep. They must be $7\frac{1}{2}$ feet high. The embrasures are 2 feet wide within, and 9 without, sloping a little downwards, to depress the metal on occasion. The distance from the centre of one embrasure to that of the other is 18 feet; that is, the guns are placed at 18 feet distance from each other; consequently the *merlins* (or that part of solid earth between the embrasures) are 16 feet within, and 7 without. The *genouillieres* (or part of the parapet which covers the car-

riage of the gun) are generally made $2\frac{1}{2}$ feet high from the platform to the opening of the embrasures; though this height ought to be regulated according to the semi-diameter of the wheels of the carriage, or the nature of the gun. The *platforms* are a kind of wooden floors, made to prevent the cannon from sinking into the ground, and to render the working of the guns more easy; and are, strictly speaking, a part of the battery. They are composed of 5 sleepers, or joists of wood, laid lengthways, the whole length of the intended platform; and to keep them firm in their places, stakes must be driven into the ground on each side: these sleepers are then covered with found thick planks, laid parallel to the parapet; and at the lower end of the platform, next to the parapet, a piece of timber 6 inches square, called a *hurter*, is placed, to prevent the wheels from damaging the parapet. Platforms are generally made 18 feet long, 15 feet broad behind, and 9 before, with a slope of about 9 or 10 inches to prevent the guns from recoiling too much, and for bringing them more easily forward when loaded. The dimensions of the platforms, sleepers, planks, hurters, and nails, ought to be regulated according to the nature of the pieces that are to be mounted. See Plate III. fig. 1.

The powder magazines to serve the batteries ought to be at a convenient distance from the same, as also from each other; the large one, at least 55 feet in the rear of the battery, and the small ones about 25. Sometimes the large magazines are made either to the right or left of the battery, in order to deceive the enemy; to be 5 feet under ground; the sides and roof to be well secured with boards, and covered with earth, clay, or something of a similar substance, to prevent the powder from being fired: they are guarded by centinels, sword in hand. The balls are piled in readiness beside the merlins, between the embrasures.

The officers of the artillery ought always to construct their own batteries and platforms, and not the engineers, as is practised in England; for certainly none can be so good judges of those things as the artillery officers, whose daily practice it is; consequently they are the properest people to direct the situation and making of batteries on all occasions.

Mortar-BATTERY. These kinds of batteries differ from gun-batteries, only in having no embrasures. They consist in a parapet of 18 or 20 feet thick, $7\frac{1}{2}$ high in front, and 6 in the rear; of a berm $2\frac{1}{2}$ or 3 feet broad, according to the quality of the earth; of a ditch 24 feet broad at the top, and 20 at the bottom. The beds,

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beds must be 9 feet long, 6 broad, 8 from each other, and 5 feet from the parapet: they are not to be sloping like the gun-platforms, but exactly horizontal. The insides of these batteries are sometimes sunk 2 or 3 feet into the ground, by which they are much sooner made than those of cannon. The powder magazines and piles of shells are placed as is mentioned in the art. GUN-BATTERY. See Pl. III. fig. 2.

Ricochet-BATTERY, so called by its inventor M. Vauban, and first used at the siege of Aeth in 1697. It is a method of firing with a very small quantity of powder, and a little elevation, so as just to fire over the parapet; and then the shot will roll along the opposite rampart, dismounting the cannon, and driving or destroying the troops. At a siege they are generally placed at about 300 feet before the first parallel, perpendicular to the faces produced, which they are to enfilade. Ricochet practice is not confined to cannon alone; small mortars and howitzers may effectually be used for the same purpose. They are of singular use in the day of battle, to enfilade the enemy's ranks; for when they perceive the shells rolling and bouncing about with their fuzes burning, expecting them to burst every moment, the bravest among them will hardly have courage to wait their approach and the fatal event.

Horizontal BATTERIES are such as have only a parapet and ditch; the platform being only the surface of the horizon made level.

Breach or Sunk BATTERIES are such as are sunk upon the glacis, with a design to make an accessible breach in the faces or salient angles of the bastion and ravelin.

Cross BATTERIES are such as play athwart each other against the same object, forming an angle there; whence greater destruction follows, because what one shot shakes, the other beats down.

Oblique-BATTERIES, or *Batteries en Ecluse*, are those which play on any work obliquely, making an obtuse angle with the line of range, after striking the object.

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Enfilading-BATTERIES are those that sweep or scour the whole length of a strait line, or the face or flank of any work.

Sweeping-BATTERIES. See *Enfilading-BATTERIES*.

Redan-BATTERIES are such as flank each other at the salient and reentrant angles of a fortification.

Direct-BATTERIES are those situated opposite the place intended to be battered, so that the balls strike the works nearly at right angles.

Reverse-BATTERIES are those which play on the rear of the troops appointed to defend the place.

Glancing-BATTERIES are such whose shot strike the object at an angle of about 20°, after which the ball glances from the object, and recoils to some adjacent parts.

Joint-BATTERIES, } when several guns fire
Comerade-BATTERIES, } on the same object at the same time. When 10 guns are fired at once, their effect will be much greater than when fired separately.

Sunk-BATTERIES are those whose platforms are sunk beneath the level of the field, the ground serving for the parapet; and in it the embrasures are made. This often happens in mortar, but seldom in gun-batteries. *BATTERY* sometimes signifies the guns themselves placed in a battery.

BATTERY-Planks are those planks or boards used in making platforms.

BATTERY-Boxes are square chests or boxes, filled with earth or dung; used in making batteries, where gabions and earth are not to be had. They must not be too large, but of a size that is governable.

BATTERY-Nails are wooden pins made of the toughest wood, with which the planks that cover the platforms are nailed. Iron nails might strike fire against the iron-work of the wheels, in recoiling, &c. and be dangerous.

Fascine-BATTERIES, } are batteries made of
Galion-BATTERIES, } those machines, where fods are scarce, and the earth very loose or sandy.

Number of men, tools, pickets, and planks for making BATTERIES, from 2 to 20 pieces of cannon, in one night.

N ^o . of guns	Length of the battery	Men to make the battery		Fascines of			Pickets	Mallets	Hand-bills	Platforms			
		Battery	fascines	Tools	10 feet	8 feet				Planks	sleepers	Pickets	Bavins
2	40	50	15	70	60	48	50	10	12	36	10	68	0
4	50	70	25	100	120	75	72	1300	18	72	20	128	100
6	76	90	35	130	170	104	48	1410	26	108	30	192	150
8	94	110	45	160	220	132	64	1820	34	144	40	256	200
10	112	130	55	190	270	160	80	2230	42	180	50	320	250
12	130	150	65	220	320	188	96	2640	50	216	60	384	300
14	148	170	75	250	370	216	112	3050	58	252	70	448	350
16	166	190	85	280	420	244	128	3460	66	288	80	512	400
18	184	210	95	310	470	272	144	3870	74	324	90	576	450
20	202	230	105	340	520	300	160	4280	82	360	100	640	500

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BATTERY-Master, whose duty formerly it was to raise the batteries. This office is now suppressed in England.

BATTERING-Pieces, } are those guns made use
BATTERING-Train, } of at a siege to make
 breaches in the works. It is judged by all
 nations that no less than 24 or 18 pounders are
 proper for that use. Formerly much larger
 calibres were used, but, as they were so
 long and heavy, became very troublesome to
 transport and manage; are now entirely re-
 jected.

BATTEURS d'Estrade. See **SCOUTS**.

BATTLE, implies an action, where the
 forces of two armies are engaged; and is
 of two kinds, *general* and *particular*; general
 where the whole army is engaged, and parti-
 cular where only a part is in action; but as they
 only differ in numbers, the methods are nearly
 alike.

The most remarkable on English record
 are the

1016. Battle of Ashdown, between Canute and
 Edmund.

1066. Battle of Hastings, where king Harold
 was slain.

1214.	Battle of	Bovines, 25 July.
1217.		Lincoln, 19 May.
1264.		Lewis, 14 May.
1265.		Evesham, 4 Aug.
1314.		Bannockburn, 25 June.
1333.	Haldon-Hill, 19 July.	
1346.		Cressy, 26 Aug.

Battle of Durham, when David, king
 of Scots, was taken prisoner, 17 Oct.

1356. Battle of Poitiers, when the king of
 France and his son were taken pri-
 soners, 19 Sept.

1388. Battle of Otterburn, between Hotspur
 and earl Douglas, 31 July.

1403.	Battle of	Shrewsbury, 12 July.
1415.		Agincourt, 25 Oct.
1421.		Beaugé, 3 April.
1423.		Crevant, June.
1424.		Fermeuil, 27 Aug.
1429.		Herrings, 12 Feb.
1455.		St. Alban's, 22 May.
1456.		Bloreheath, 23 Sept.
1460.		Northampton, 10 July.
1461.		Wakefield, 24 Dec.

1461.	Battle of	Touton, 29 March.
1464.		Hexham, 15 May.
1469.		Banbury, 26 July.
1470.		Stamford, March.
1471.		Barnet, 14 April.
1485.	Tewkesbury, 4 May.	
		Bosworth, 22 Aug.

B A T

1487.	Battle of	Stoke, 6 June.
1497.		Blackheath, 22 June.
1513.	Battle of Flouden, 9 Sept. when James IV. king of Scots, was killed.	

1542.	Battle of	Solway, 24 Nov.
1547.		Pinkey, 10 Sept.
1557.		St. Quintin, 10 Aug.
1642.		Edgehill, 24 Oct.
1643.		Shatton, 16 May.
		Lansdown, 5 July.
		Roundawaydown, 13 July
		Newbury, 20 Sept.
		Marston-moor, 2 July.
		Naseby, June.
		Dunbar, 3 Sept.
		Worcester, 3 Sept.
		Bothwell-bridge, 22 June
		Boyne, 1 July.
		Aughrim, 22 July.
		Steinkirk.
		Blenheim, 13 Aug.
		Ramillies, on Whit Sunday
		Oudenard, 30 June.
		Wynendale, 28 Sept.
	Malplaquet, 11 Sept.	
	Blaregmes, 14 Sept.	
	Dumblain, 12 Nov.	
	Dettingen, 26 June.	
	Fontenoy, 30 Apr.	
	Preston-pans, 21 Sept.	
	Falkerk, 17 Jan.	
	Culloden, 16 April.	
	Laffeld, 20 July.	
	Lobositz, 1 Oct.	
	Rosbach, 5 Nov.	
	Reichenberg, 21 April.	
	Gros Jegerndorff, 30 Aug.	
	Breslau, 22 Nov.	
	Lissa, 5 Dec.	
	Haftenbeck, 26 July.	
	Kolin, 13 June.	
	Prague, 6 May.	
	Sanderhausen, 23 July.	
	Crevelt, 23 June.	
	Meer, 5 Aug.	
	Zorndorff, 25 Aug.	
	Sanderhagen, 10 Oct.	
	Munden, 11 Oct.	
	Huchkerken, 14 Oct.	
	Cunnersdorf, 12 Aug.	
	Bergen, 13 April.	
	Zullichau, 23 July.	
	Coefeld, 1 Aug.	
	Minden, 1 Aug.	
	Torgau, 8 Sept.	
	Pretsch, 29 Oct.	

1758.

1759.

1759.	} Battle of	Abraham, 13 Sept.
1760.		Moxen, 20 and 21 Nov.
		Cosford, 20 Feb.
		Quebec, 28 April.
		Grabentleyn, 4 June
		Corbach, 24 June.
		Enskloff, 9 July.
		Warburg, 31 July.
		Strehlen, 2 Aug.
		Leignitz, 15 Aug.
1761.		Torgau, 2 Nov.
	}	Langensaltze, 15 Feb.
		Grünberg, 21 March.
		Vellinghausen, 16 July.
		Kirkdenckern, 15 July.
		Finbeck, 24 Aug.
1762.		Dobeln, 12 May.
		Wilhelmstahl, 24 June.
		Fulda, 23 July.
		Friedberg, 30 Aug.
		Freyberg, 10 and 29 Oct.
1775.		Bunker's-hill, 17 June.

There is no action in war more brilliant than that of battles. Their success sometimes decides the fate of kingdoms. It is by this action a general acquires his reputation. It is in battle that his valour, his force of genius, and his prudence, appear in their full extent; and where especially he has occasion for that firmness of mind, without which the most able general will hardly succeed.

Battles have ever been the last resource of good generals. A situation where chance and accident often baffle and overcome the most prudential and most able arrangements, and where superiority in numbers by no means ensures success, is such as is never entered into without a clear necessity for so doing. The fighting a battle only because the enemy is near, or from having no other formed plan of offence, is a direful way of making war. Darius lost his crown and life by it: king Harold, of England, did the same; and Francis I. at Pavia, lost the battle and his liberty. King John, of France, fought the battle of Poitiers, though ruin attended his enemy if he had not fought.

The true situation for giving battle is when an army's situation cannot be worse, if defeated, than if it does not fight at all; and when the advantage may be great, and the loss little. Such was the duke of Cumberland's at Hastenbeck, in 1757, and prince Ferdinand's at Vellinghausen, in 1761. The reasons and situations for giving battle are so numerous, that to treat of them all would fill a large volume: I will therefore content myself

with the following. There may be exigencies of state that require its army to attack the enemy at all events. Such were the causes of the battle of Blenheim, in 1704, of Zorndorff, in 1758, of Cunnersdorff, in 1759, and of Rosbach, in 1757. To raise a siege, to defend or cover a country. An army is also obliged to engage when shut up in a post. An army may give battle to effectuate its junction with another army, &c.

The preparations for battle admit of infinite variety. By a knowledge of the detail of battles, the precept will accompany the example. The main general preparations are, to profit by any advantage of ground; that the tactical form of the army be in some measure adapted to it; and that such form be, if possible, a form tactically better than the enemy's; and, in forming the army, to have a most careful attention to multiply resources, so that the fate of the army may not hang on one or two efforts; to give any particular part of the army, whose quality is superior to such part in the enemy's army, a position that ensures action; and, finally, to have a rear by nature, or if possible, by art, capable of checking the enemy in case of defeat.

The dispositions of battles admit likewise of an infinite variety of cases; for even the difference of ground which happens at almost every step, gives occasion to change the disposition or plan; and a general's experience will teach him to profit by this, and take the advantage the ground offers him. It is an instant, a *coup-d'œil*, which decides this: for it is to be feared the enemy may deprive you of those advantages, or turn them to his own profit; and for that reason this admits of no precise rule, the whole depending on the time and the occasion.

With regard to battles there are three things to be considered; what precedes, what accompanies, and what follows the action. As to what precedes the action, you should unite all your force, examine the advantage of the ground, the wind, and the sun, (things not to be neglected) and chuse, if possible, a field of battle proportioned to the number of your troops.

You must post the different kinds of troops advantageously for each: they must be so disposed as to be able to return often to the charge; for he who can charge often with fresh troops, is commonly victorious. Your wings must be covered so as not to be surrounded, and you must observe, that your troops can assist each other without any confusion, the intervals being

B A T

being proportioned to the battalions and squadrons.

Great care must be taken about the regulation of the artillery, which should be disposed so as to be able to act in every place to the greatest advantage; for nothing is more certain than that, if the artillery be well commanded, properly distributed, and manfully served, it will greatly contribute to gaining the battle; being looked upon as the general instrument of the army, and the most essential part of military force. The artillery must be well supplied with ammunition, and each soldier have a sufficient number of cartridges. The baggage, provisions, and treasure of the army, should, on the day of battle, be sent to a place of safety.

In battle, where the attacks are, there is also the principal defence. If an army attacks, it forms at pleasure; it makes its points at will: if it defends, it will be sometimes difficult to penetrate into the designs of the enemy, but when once found, succour succeeds to the discovery. Ground and numbers must ever lead in the arrangement of battles; impression and resource will ever bid fairest for winning them.

BATTLE-Array, } the method and order of
Line of BATTLE, { arranging the troops in order or line of battle; the form of drawing up the army for an engagement. This method generally consists of three lines, viz. the front line, the rear line, and the reserve.

The second line should be about 300 paces behind the first, and the reserve at about 5 or 600 paces behind the second. The artillery is likewise divided along the front of the first line. The front line should be stronger than the rear line, that its shock may be more violent, and that, by having a greater front, it may more easily close on the enemy's flanks. If the first line has the advantage, it should continue

Bore	- - - - -	
Lower bed	- - - {	length - -
		breadth - -
		height - -
Upper bed	- - - {	length - -
		breadth - -
		height - -
Breadth of quarter round	- - -	
of the ogee and fillet	- - -	
Length of the cavity	- - -	
Trunnion-hole from fore end	- -	
Diameter	} of trunnion-holes	- -
Depth		- -

N. B. These are the dimensions of the present land mortars. The column at top contains the diameter of each mortar, expressed in inches; the other columns are likewise inches

B E D

to act, and attack the enemy's second line, terrified by the defeat of their first. The artillery must always accompany the line of battle in the order it was at first distributed, if the ground permit it; and the rest of the army should follow the motions of the first line, when it continues to march on after its first success.

BATTLE-Ax, an offensive weapon, formerly much used by the Danes, and other northern infantry. It was a kind of halbert, and did great execution when wielded by a strong arm.

Main-BATTLE. See **BATTLE-Array**.

BAVINS, in military affairs, implies small faggots, made of brush-wood, of a considerable length, no part of the brush being taken off. See **FASCINES**.

BAYONET, a kind of short hollow dagger, made with a hollow handle, and a shoulder, to fix on the muzzle of a firelock or musket, so that neither the charging nor firing is prevented by its being fixed on the piece; and is of infinite service against the horse. At first the bayonet was screwed into the muzzle of the barrel, consequently could not be used during the fire. It is said to have been invented by the people of Malacca, and first made use of on quitting the pikes.

BEAT, in a *military sense*, signifies to gain the day, to win the battle, &c.

To BEAT a parley. See **CHAMADE**.

To BEAT a drum. See **DRUM**.

BEDS, in the military language, are of various sorts, viz.

Mortar-BEDS serve for the same purpose as a carriage does to a cannon: they are made of solid timber, consisting generally of 2 pieces fastened together with strong iron bolts and bars. Their sizes are according to the kind of mortar they carry, and their various dimensions are specified in the following table. See Plate IV.

13	10	8	5.8	4.6
84.	66.	50.	..	..
33.	20.	..	..	..
13.	10.	9.		
83.	65.	49.	31.5	28.5
32.	25.	19.	16.	14.
13.	12.	11.	10.	9.
3.	2.5	2.5		
4.	3.5	3.		
20.	16.	12.	8.	5.7
31.	20.	15.5	13.3	11.7
7.2	6.4	5.4	3.4	2.4
7.	6.	5.	3.2	2.2

and decimals. The distance of the trunnion-holes is measured from the quarter round, and not from the end of the bed. Vid. plate I.

B E D

Names and number of iron-work in a 13, 10, and 8-inch mortar-bed.

Cap-squares	-	-	2	End riveting-plates	2
Eye-bolts	-	-	2	Middle plate	-
Joint-bolts	-	-	2	Riveting-bolts	-
Under and up- per bed-bolts	}	-	9	Square riveting- plates	}
Dowel-bars				Traversing-bolts	
Rings with bolts	-	-	4	Keys, chains and staples	}
Reverſe-bars	-	-	2		

Names and number of iron-work in a royal and cohorn mortar-bed. Vid. plate IV. fig. 1 and 2.

Cap-squares	-	-	2	Handles with ſtarts	2
Eye-bolts	-	-	2	Square riveting- plates	}
Joint-bolts	-	-	2		
Riveting-bolt and ring	}	-	1	Keys, chains and ſtaples	}

Royal-BEDS, } are carriages for a royal
Cochorn-BEDS, } mortar, whole diameter is
5.8 inches ; and a cohorn mortar, whoſe dia-
meter is 4.6 inches, as mentioned in the pre-
ceding table. Theſe beds are made of one
ſolid block only. Plate IV.

Sea-Mortar-BEDS, are likewiſe made of ſolid
timber, like the former, but differ in their
form, having a hole in the centre to receive
the pintle or ſtrong iron bolt, about which the
bed turns. Sea-mortars are mounted on theſe
beds, on board of the bomb-ketches. See
Plate V.

Dimensions of the preſent Sea-Mortar-beds.

Diameter of the bore	-	-	-	13	10
Length	}	of the bed	{	94	84
Breadth				54	17
Height				27	23
Pintle-hole from the fore end	-	-	-	39	32
Diameter of the pintle-hole	-	-	-	6.5	6.5
Trunnions from the fore end	-	-	-	46	42.5
Diameter of the trunnion-holes	}	of the	{	10	8
Depth				8	5
Diameter of the circular bed	}	of the	{	59	59
Height				8	6
Distance to the bed-bolſter	-	-	-	15	10
Depth of the cavity	-	-	-	15	12
Its opening above	-	-	-	30	21
Bed bolſter length	-	-	-	53	44
Length below	-	-	-	29	21
Its height	-	-	-	16	17
Its breadth	-	-	-	14	12

N. B. Theſe beds are placed upon very ſtrong
timber frames, fixed into the bomb-ketch, in
which the pintle is fixed, ſo as the bed may
turn about it, to fire any way. The fore part
of theſe beds is an arc of a circle deſcribed
from the ſame centre as the pintle-hole. The
plans, elevations, and ſections, ſhew in a diſtant
manner the ſeveral parts of theſe beds. See
Plate V.

B I L

*Names and quantity of iron-work in ſea-
mortar-beds.*

Cap-squares	-	-	2	Croſs bed-bolts	-
Eye-bolts	-	-	6	Down bed-bolts	15
Loop-bolts	-	-	4	Bed bolſter-plates	2
Traversing-bolts	-	-	4	Keys, chains, and ſtaples	}
Middle-plate	-	-	1		
Riveting plates	-	-	2	Nails to the bed- bolſter bed	}
Riveting-bolts	-	-	6		
Square riveting- plates for ditto	}	-	7	Bed-bolſter rings and loops	4

Stool-BED, is a piece of wood on which the
breach of a gun reſts upon a truck-carriage,
with another piece fixed to it at the hind end,
that reſts upon the body of the hind axle-tree ;
and the fore part is ſupported by an iron bolt.
See CARRIAGE.

BED-Bolts.

BED-Bolſters.

Stool BED-Bolts.

SEE CARRIAGES AND BEDS.

BEE-TLES, in a *military ſenſe*, are large
wooden hammers for driving down palifades,
and for other uſes, &c.

BELLS of Arms. See ARMS.

BELTS, in a *military ſenſe*, are of ſeveral
forts ; as

Sword-BELTS, a well-known machine, in which
the ſword hangs.

Shoulder-BELTS, a broad leather belt, which
goes over the ſhoulder, and to which the pouch
fixed. They ſhould be made of ſtout ſmooth
buff, about 3 inches broad, with two buckles
to fix the pouch to the belt. See POUCH.

BERM, in *fortification*, is a little ſpace or
path, of about 4, 6, or 8 feet broad, according
to the height and breadth of the works, be-
tween the ditch and the parapet, when made of
tuſs, to prevent the earth from rolling into the
ditch ; and ſerves likewiſe to paſs and repaſs.

BESIEGERS, the army that lays ſiege to a
fortified place.

BESIEGED, the garrison that defends the
place againſt the army that lays ſiege to it.
See SIEGE.

BILLET, a well-known ticket for quarter-
ing ſoldiers.

BILLETING, in the *army*, implies the quar-
tering ſoldiers in the houſes of any town or
village ; which billet intitles each ſoldier, by
act of parliament, to candles, vinegar, ſalt,
and either ſmall-beer or cyder, not exceeding
5 pints for each man per day, gratis ; with the
uſe of fire, and the neceſſary utenſils for dreſ-
ſing and eating their meat : but, provided the
landlord agrees to board them, they are to pay
as follows :

Each

Each officer of horse, under the degree of a captain, per diem, 2s.

Each officer of dragoons, under the degree of a captain, 1s 6d.

Each officer of foot, under the degree of a captain, 1s. and with a horse, 6d. more.

Each light-horsemán or dragoon, with horse, 1s.

Each foot soldier, 4d.

BIOVAC, in *military affairs*, signifies a guard at night, performed by the whole army, which either at a siege, or encamped before an enemy, turn out of their tents under arms, and continue so all night, to prevent a surprise. When troops are very much harrassed, or the dread of the enemy is not great, the two front ranks only remain under arms, whilst the rear ranks rest by their arms on the ground; and so alternately

BLAST, and **BLASTING**. See **MINES** and **MINING**.

BLINDS, in *military affairs*, are wooden frames, composed of 4 pieces, either flat or round, two of which are 6 feet long, and the others 3 or 4 feet, which serve as spars to fasten the two first together: the longest are pointed at both ends, and the two others are fastened towards the extremities of the former, at about 10 or 12 inches from their points, the whole forming a rectangular parallelogram, the long sides of which project beyond the other about 10 or 12 inches. Their use is to fix them either upright, or in a vertical position, against the sides of the trenches or saps, to sustain the earth. Their points at the bottom serve to fix them in the earth, and those at top to hold the fascines that are placed upon them, so that the sap or trench is formed into a kind of covered gallery, to secure the troops from stones and grenades.

The term *Blind* is also used to express a kind of hurdle, made of the branches of trees, behind which the soldiers, miners, or labourers, may carry on their work without being seen. See **HURDLE**.

BLINDS, are sometimes only canvas stretched to take away the sight of the enemy. Sometimes they are planks set up, for which see **MANTLET**. Sometimes they are made of a kind of coarse basket-work. See **GABIONS**. Sometimes of barrels, or sacks filled with earth. In short, they signify any thing that covers the labourers from the enemy.

BLIND. See **ORILLON** and **FORTIFICATION**.

BLOCKADE, } in *military affairs*, implies
BLOCKADING, } the surrounding a place with different bodies of troops, who shut up

all the avenues on every side, and prevent every thing from going in or out of the place. The design of the blockade is to oblige those who are shut up in the town to consume all their provisions, and by that means to compel them to surrender for want of subsistence.

Hence it appears that a blockade must last a long time, when a place is well provided with necessaries; for which reason this method of reducing a town is seldom taken, but when there is reason to believe the magazines are unprovided, or sometimes when the nature or situation of the place permits not the approaches to be made, which are necessary to attack it in the usual way.

Maritime towns, which have a port, are in much the same case as other towns, when their port can be blocked up, and the besiegers are masters of the sea, and can prevent succours from being conveyed that way into the place.

To BLOCKADE, or to block up a place, is to shut up all the avenues, so that it can receive no relief either of men or provisions, &c.

To raise a BLOCKADE, is to march from before the place, and leave it free and open as before.

To turn a siege into a BLOCKADE, is to desist from a regular method of besieging, and to surround the place with those troops who had formed the siege.

To form a BLOCKADE, is to surround the place with troops, and hinder any thing from going either in or out.

BLUNDERBUSS, a well-known fire-arm, consisting of a wide, short, but very large bore, capable of holding a number of musket or pistol balls, very fit for doing great execution in a croud, to make good a narrow passage, door of a house, stair-case; or in boarding a ship.

BOARD of Ordnance. See **ORDNANCE**.

BOARD, also implies an office under the government, where the affairs of some department are transacted; of which there are several sorts in England.

BODY, in *the art of war*, is a number of forces, horse or foot, united and marching under one commander.

Main Body of an army, sometimes means the troops encamped in the centre between the two wings, and generally infantry. The main body on a march, signifies the whole of the army, exclusive of the van and rear-guard.

Body of Reserve. See **RESERVE**.

Body of a place, is, generally speaking, the buildings in a fortified town; yet the inclosure round them is generally understood by it.

BOISTERS.

B O L

BOLSTERS. See WAGGONS.

BOLTS, in *gunnery*, are of several sorts : as,

1. *Eye*
2. *Joint*
3. *Transom*.
4. *Bed*
5. *Breeching*
6. *Bracket*
7. *Stool-bed*
8. *Garnish*
9. *Axle-tree*
10. *Bolster*

} **BOLTS.** See CARRIAGE.

See SHELL.

BOMB } *Chest.* See CAISSON.

Engels } small vessels, made very

Ketches } strong with large beams,

particularly calculated for throwing shells into a town, &c. i.e. or fortification, from 13 and 10-inch mortars; two of which are placed on board of each ship. They are said to have been invented by one M. Reyneau, a Frenchman, and to have been first put in action at the bombardment of Algiers in 1681: 'till then it had been judged impracticable to bombard a place from the sea.

BOMBARD, an ancient piece of ordnance so called, very short, and very thick, with an uncommon large bore. There have been bombards which have thrown a ball or shell of 300 weight: they made use of cranes to load them. The Turks use some of them at present.

BOMBARDIERS, artillery soldiers, so called because they are always employed in mortar and howitzer duty. They are to load them on all occasions; and in most services they load the shells and grenades, fix the fuzes, prepare the composition both for fuzes and tubes, and fire both mortars and howitzers on every occasion. In the English service, shells and grenades, composition for the same, fuzes, &c. are prepared in the laboratory by people well skilled in that business.

In most foreign services both officers and soldiers belonging to the companies of bombardiers have an extraordinary pay, as it requires more mathematical learning to throw shells with some degree of exactness, than is requisite for the rest of the artillery. See ARTILLERY REGIMENT.

To **BOMBARD**,
BOMBARDING,
BOMBARDMENT, } the act of assaulting
 } a city or fortress, by
 } throwing shells into
 it, in order to set fire to, and ruin the houses, churches, magazines, &c. and to do other

B O M

mischief. As one of the effects of the shell results from its weight, it is never discharged as a ball from a cannon, that is, by pointing it at a certain object: but the mortars in England are fixed at an elevation of 45 degrees; that is, inclined so many degrees from the horizon, that the shell describes a curve, called the military projectile: hence a mortar, whose trunnions are placed at the breech, can have no point-blank range. I am of opinion that mortars should be so contrived, that they may be elevated to any degree required, as much preferable to those fixed at an angle of 45°. because shells should never be thrown at that angle but in one single case only, which seldom happens; that is, when the battery is so far off, that they cannot otherwise reach the works: for when shells are thrown from the trenches into the works of a fortification, or from the town into the trenches, they should have as little elevation as possible, in order to roll along, and not bury themselves; whereby the damage they do, and the terror they cause to the troops, is much greater than if they sink into the ground. On the contrary, when shells are thrown upon magazines, or any other buildings, with an intention to destroy them, the mortar should be elevated as high as possible, that the shells may acquire a greater force in their fall.

Shells should be loaded with no more powder than is requisite to burst them into the greatest number of pieces, and the length of the fuzes should be exactly calculated according to the required ranges; for, should the fuze set fire to the powder in the shell before it falls on the place intended, the shell will burst in the air, and probably do more mischief to those who fired the mortar, than to those against whom it was discharged. To prevent this, the fuzes are divided into as many seconds as the greatest range requires, consequently may be cut to any distance, at an elevation of 45 degrees.

Mortars are not to be fired with two fires; for when the fuze is properly fixed, and both fuze and shell dredged with mealed powder, the blast of the powder in the chamber of the mortar, when inflamed by the tube, will likewise set fire to the fuze in the shell.

The following table of loaded-shells experiments, was the medium of three different trials, out of the different mortars mentioned, at the Prussian camp near Meyßen, in 1761.

TABLE of LOADED-SHELLS EXPERIMENTS.

Nature of land-mortars.		Powder in the chamber.			Weight of the mortar.			Strokes to drive the fuze.		Weight of the shell fixed.		Weight of powder the shell contains.		Quantity of powder used.		Time of flight.		Elevation.		Remarks.	
Inch.		lb.	oz.	c.	qr.	lb.	N ^o .	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	s.	°	'			
13		4	8	24	2	1	21	194	"	9	4½	8	—	16	30	30				broke in 18 pieces	
"		3	"	"	"	"	"	192½	"	"	"	7	8	19	45	—				do.	26 do.
10		3	5	10	2	11	18	90	—	4	14½	4	6	12	35	15				do.	13 do.
"		2	"	"	"	"	"	89	5	"	"	3	12	14	38	30				do.	22 do.
Royal		—	10	—	2	18	12	16	—	1	2	1	—	10	28	25				do.	8 do.
"		—	12	—	"	"	"	15	12	"	"	—	14	13	40	—				do.	19 do.
Coch.		—	5	—	2	28	"	8	4	—	8	—	7	12	30	—				do.	6 do.
"		—	6	—	"	"	10	8	5	—	"	—	6	14	38	30				do.	12 do.

BONNETS, in *fortification*, implies a small but useful work, that greatly annoys the enemy in their lodgments: is a work consisting of 2 faces, which make a salient angle in the nature of a ravelin, without any ditch, having only a parapet 3 feet high, and 10 or 12 feet broad. They are made at the salient angles of the glacis, outworks, and body of the place, beyond the counterscarp, and in the sauticbray. See FORTIFICATION.

BONNETS à Prêtres, or *Priest's-cap*, in *fortification*, is an outwork, having three salient and two inward angles, and differs from the double tenaille only in having its sides incline inwards towards the gorge, and those of a double tenaille are parallel to each other. See FORTIFICATION.

BORDER, in *military drawings*, implies single or double lines, or any other ornament, round a drawing, &c.

BOOKS, *military*, the composition of military gentlemen of experience, genius, and learning, in order to communicate the various branches of the art of war to the public, and to posterity. It is certain that books are one of the chief instruments of acquiring knowledge. They are the repositories of the military sciences, and the vehicles of learning of every kind. As such, I will put down a few of the best military books in the English, German, Dutch, and French languages.

Some of the best Books of artillery and gunnery in English.

Robin's Gunnery, &c. 2 vol. 8vo. 1761.

Muller's Treatise of Artillery, 8vo. 1768.

Muller's Appendix to the treatise of Artillery, 8vo. 1768.

Williams's Theory and Practice of Gunnery, 8vo. 1766.

Simpson's Theory of Gunnery, 8vo. 1758.

Hollyday's Practical Gunnery, 12mo. 1766.

Gray's Gunnery, 8vo. 1731.

Ardefoif's Marine Fortification and Gunnery, 8vo. 1772.

Euler's Gunnery, by Mr. Brown, 4to. 1777.

In German.

Struenfsee Anfangsgründe der Artillerie, 8vo. 1769.

Eulers erläuterte Artillerie, 8vo. 1756.

Birnbaums Unterricht für einen Artilleristen, 4to. 1752.

Buchner's Theoria & Praxis Artilleriæ (in German) 3 vol. folio, printed in 1682, 1683, and 1685 (*).

Dilichius Peribologia (in German) folio, 1640 (+).

In French.

Nouveau Cours de Mathématique, à l'usage de l'Artillerie, par Belidor, 4to. 1758.

Théorie nouvelle sur le Mécanisme de l'Artillerie, par du Lacq, 4to. 1751.

Mémoires de l'Artillerie, par St. Remy, 3 vol. 4to. 1745.

Traité de l'Artillerie, par le Blond, 3 vol. 8vo. 1743.

Observations sur le Canon, 4to. 1772.

Essai sur l'usage de l'Artillerie, 8vo. 1771.

Examen

(*) This valuable book, on account of its being printed at three different places, and of three different dates, is become exceeding scarce even in Germany.

(†) This was probably the first printed book of artillery, and is seldom met with.

Examen de la Poudre, traduit de l'Italien par Flavigny, 8vo. 1773.

Some of the best Books of fortification in English.

Riou's Elements of Fortification, 4to, 1746. vol. 1. *The 2d was never published.*

Muller's Theory and Practice of Fortification, 2 vol. 8vo. 1764.

Horneck's Remarks on Modern Fortification, 4to. 1758.

Coehorn's Fortification, translated by Saverey, folio, 1708.

In German and Dutch.

Speckle, Architectur von Festungen, folio, 1592. Sec. Edit. 1608 (*).

Dögen's Niederlandische Fortification, folio, 1648.

Celarius vollkommener Festungsbau, folio, 1656.

Freytag's Fortification, folio, 1665.

Scheiters neuer Festungsbau, folio, 1672.

Gründels neu erfundene Fortification, folio, 1673.

Sturms gründliche Anleitung zur Kriegsbaukunst, 3 vol. 4to. 1755.

Bellerheim irreguläre Festungen, 4to. 1765.

Hahns Kriegs-bau-kunst, 8vo. 1775.

Humberts Kriegs-kunst, 8vo. 1756.

Zuckows Kriegs Baukunst, 4to. Frankf. 1769.

Coehorn's nicuwe Vesting-bouw, folio, 1685.

Verstärkinge des vyf-hooks, folio, 1682.

Coehorn's Wederleginge des Architectura militaris, folio, 1683.

In French, Spanish, and Italian.

Piedro de Navaro, l'ortificatione; *supposed to be the first printed book of fortification; without date.*

Francisco Jeorg Senensis, Fortificazione; *no date.*

Gerolamo Maggi, del Fortificazione, folio, 1559.

Francisco de Marchi, Fortificazione, 3 vol. grandos, Roma, 1546 (†).

Pietro Paola Floriani, Fortificazione, folio, 1654.

Pietro Sardi, Corona Imperiale del l'Architettura milit. 1677.

Les Fortifications, par De Ville, 4to. 1666.

Les Fortifications, par M. Pagan, folio, 1663. Architecture militaire, par un Officier de Distinction, 2 vol. 4to. 1741.

Vauban véritable Manière de fortifier, par du Fay, 2 vol. 4to. 1757.

Essai sur la Fortification, 8vo. 1755.

Some of the best Books on the art of war, in English.

Muller's Attack and Defence of fortified places, 8vo. 1769.

Muller's Field Engineer, from Clairac, 8vo. 1760.

Bell, on Military first Principles, 8vo. 1770.

Elementary Principles of Tactics, 8vo. 1771.

Dalrymple's Military Essays, 8vo. 1761.

Bigg's Military History, from 1739 to 1748, 8vo. 1756.

Pleydel's Essay on Field Fortification, 8vo. 1768.

Entick's History of the late War, 5 vol. 8vo. 1766.

La Cointe's Science of Military Posts, 8vo. 1761.

Military Instructions for Officers detached in the Field, 1770.

Le Blond's Military Engineer, 2 vol. 8vo. 1759.

Mac Intire's Treatise of the Marine Forces, 8vo. 1763.

Jones on Artificial Fireworks, 8vo. 1768.

Treatise of the late Wars in the Netherlands, 8vo. 1759.

Simes's Military Works, 3 vol. 8vo. 1772.

Lloyd's History of the late Wars, 1 vol. 4to. 1772. *The 2d was never published.*

Turpin's Art of War, by Otway, 2 vol. 4to. 1761.

In German.

Frederici anleitung zur Kriegs-Wissenschaft, 8vo. 1763.

Genies praktische Kriegs-kunst, 8vo. 1760.

Von Lohens Soldat, oder Abhandlung vom Kriegs-stande, 8vo. 1752.

Historie des Kriegs, 6 vol. 8vo. 1758-1762.

Königs von Preussen Unterricht von der Kriegs-kunst an Seine Generals, 8vo. 1761.

Tölner Bildung eines jungen Officiers, 8vo. 1763.

Faßh große Meister in der Kriegs-kunst, 8vo. 1764.

Jeney der Parteygänger, 8vo. 1766.

Tielke's Feld-Ingenieur, 8vo. Leipz. 1774. Tielkes

(*) Is very scarce, and very valuable, both the editions.

(†) This is the first printed book of fortification with a date, and supposed to be even the very first. History informs us that there are only 3 or 4 copies in being; 1 in the king of Prussia's library, 1 or 2 in Italy, and 1 in the possession of colonel Pattison, of the royal artillery.

Tielkes Kriegs-kunst, 4to. Freyb. 1776.
Guiberts Versuch über die Tactik, 2 vol. 8vo. Dresd. 1774.

In French.

Art de Guerre, par Principes, & par Règles, par Puitségur, 2 vol. folio, 1749.

Attaque & la Défense des Places, par Vauban, 2 vol. 4to. 1742.

Histoire militaire du Prince Eugene, du Duc de Marlborough, & du Prince d'Orange, par Dumond & Rouflet, 2 vol. folio. 1747.

Petit Guerre, par Grand-Maison, 2 vol. 8vo. 1756.

L'Ecole de Mars, par de Guignard, 4to. 1758.

Histoire générale des Guerres, arrivées dans le monde de depuis le Déluge, jusques en 1748, 2 vol. 4to. 1756.

Histoire de Polybe, par M. de Folard, 6 vol. 4to. 1729.

Traité général des Substances militaires, 2 vol. 4to. 1744.

Traité de la Guerre dernière en Allemagne, 6 vol. 8vo. 1763.

Mémoires de Montecuculi, 2 tom. 8vo. 1758.

Mémoires militaires du Duc de Luxemburg, 6 tom. 4to. 1756.

Guibert, Essai général de Tactique, 4to. Lond. 1772.

BOOM, in *marine fortification*, is a long piece of timber, with which rivers or harbours are stopped, to prevent the enemy's coming in: it is sometimes done by a cable or chain, and floated with yards, top-masts, or spars of wood lashed to it.

BORÉ, in *gunnery*, implies the cavity of the barrel of a gun, mortar, howitzer, or any other piece of ordnance. &c. **CANNON**.

BOW, an ancient weapon of offence, made of steel, wood, or other elastic matter; which, after being bent by means of a string fastened to its two ends, in returning to its natural state, throws out an arrow with prodigious force.

The use of the bow is, without all doubt, of the earliest antiquity. It has likewise been the most universal of all weapons, having obtained amongst the most barbarous and remote people, who had the least communication with the rest of mankind.

The bow is a weapon of offence amongst the inhabitants of Asia, Africa, and America, at this day; and in Europe, before the invention of fire-arms, a part of the infantry was armed with bows. Lewis XII. first abolished the use of them in France, introducing, in their

stead, the halbert, pike, and broad sword. The long-bow was formerly in great use in England, and many laws were made to encourage the use of it. The parliament under Henry VII. complained of the disuse of long-bows, heretofore the safeguard and defence of this kingdom, and the dread and terror of its enemies.

Cross-Bow, is likewise an ancient weapon of offence, of the eleventh century. Philip II. surnamed the Conqueror, introduced cross-bows into France. In this reign Richard I. of England, was killed by a cross-bow at the siege of Chalus.

BOXES, in *military affairs*, are of several sorts, and for various purposes.

Nave-Boxes, are made of iron, and fastened one at each end of the nave, to prevent the arms of the axle-tree, about which the boxes turn, from causing too much friction.

Wood-Boxes, with lids, for holding grape-shot, &c. each calibre has its own, distinguished by marks of the calibre on the lid.

Tin-Boxes, such as are filled with small shot for grape, according to the size of the gun they are to be fired out of.

BOYAU, in *fortification*, is a particular trench separated from the others, which, in winding about, incloses different spaces of ground, and runs parallel with the works of the place, that it may be entailed. When two attacks are made at once, one near to the other, the boyau makes a communication between the trenches, and serves as a line of contravallation, not only to hinder the sallies of the besieged, but likewise to secure the miners.

BRACES, in a *military sense*, signifies a kind of armour for the arm; they were formerly a part of a coat-of-mail.

BRACKETS, in *gunnery*, are the checks of the travelling carriage of a mortar; they are made of strong wooden planks. This name is also given to that part of a large mortar-bed, where the trunnions are placed, for the elevation of the mortar: they are sometimes made of wood, and more frequently of iron, of almost a semicircular figure, well fastened with nails and strong plates.

BRANCH. See **GALLERY**.

BREACH, in *fortification*, a gap, or opening, in any part of the works of a fortified place, made by the artillery or mines of the besiegers, preparatory to the making an assault.

To repair a BREACH, is to stop or fill up the gap with gabions, fascines, &c. and prevent the assault.

To fortify a BREACH, is to render it inaccessible with chevaux-de-frize, crow's-feet, &c.

To make a lodgment in the BREACH. After the besieged are driven away, the besiegers secure themselves against any future attack in the breach.

To clear the BREACH, that is, to remove the ruins, that it may be the better defended.

To BREAK ground, to begin to open and work at the trenches in a siege, &c.

BREAST-PLATE, in *military antiquity*, a piece of defensive armour worn on the breast of both men and horses. They are but seldom used now.

BREAST work. See **PARAPET**.

BRECH of a gun, the end near the vent. See **CANNON**.

BRICKS, in *military architecture*, supply the place of stone in common buildings, and are composed of an earthy matter, hardened by art, to a resemblance of that kind: they may be very well considered as artificial stone. Bricks are of very great antiquity, as appears from sacred history, the tower of Babel being built with them; and it is said the remains are still visible. The Greeks and Romans, &c. generally used bricks in their buildings, witness the Pantheon, &c. In the east they baked their bricks in the sun. The Romans used them unburnt, having first left them to dry in the air for 3, 4, or 5 years.

The best bricks must not be made of any earth that is full of sand or gravel, nor of such as is gritty or stony; but of a greyish marl, or whitish chalky clay, or at least of reddish earth. But if there is a necessity to use that which is sandy, choice should be made of that which is tough and strong.

The best season for making bricks is the spring; because they will be subject to crack, and be full of chinks, if made in the summer: the loam should be well steeped or soaked, and wrought with water. They are shaped in a mould, and, after some drying in the sun or air, are burnt to a hardness. This is our manner of making bricks; but whether they were always made in this manner admits a doubt. We are not clear what was the use of straw in the bricks for building in Egypt, or why in some part of Germany they mix saw-dust in their clay for bricks.

We are in general tied down by custom to one form, and one size; which is truly ridiculous: 8 or 9 inches in length, and 4 in breadth, is our general measure: but beyond doubt there might be other forms, and other sizes, introduced very advantageously.

Campess Bricks, are of a circular form; their use is for steening of walls: we have also

concave, and semi-cylindrical, used for different purposes.

Grey-Stocks, are made of the purest earth, and better wrought: they are used in front in building, being the strongest and handfomest of this kind.

Place-BRICKS, are made of the same earth, or worse, with a mixture of dirt from the streets, and being carelessly put out of hand, are therefore weaker and more brittle, and are only used out of sight, and where little stress is laid on them.

Red-Stocks, are made of a particular earth, well wrought, and little injured by mixtures: they are used in fine work, and ornaments.

Hedge-Bricks, are made of a yellowish coloured loam, very hard to the touch, containing a great quantity of sand: their particular excellence is, that they will bear the greatest violence of fire without hurt.

BRIDGES, in *military affairs*, are of several sorts and denominations, viz.

Rush-BRIDGES, are made of large bundles of rushes, bound fast together, over which planks are laid, and fastened: these are put in marshy places, for the army to pass over on any emergency.

Pendant or hanging BRIDGES, are those not supported by posts, pillars, or batments, but hung at large in the air, sustained only at the two ends.

Draw-BRIDGE, that which is fastened with hinges at one end only, so that the other may be drawn up; in which case the bridge is almost perpendicular, to hinder the passage of a ditch, &c. There are others made to draw back and hinder the passage; and some that are open in the middle, one half of which turns away to one side, and the other half to the other, and both again joined at pleasure.

Long BRIDGE, is generally made of two small bridges, laid one over the other, in such a manner that the uppermost stretches, and runs out, by the help of certain cords running through pulleys placed along the sides of the upper bridge, which push it forwards, till the end of it joins the place it is intended to be fixed on. They are frequently used to surprise works, or out-posts that have but narrow ditches.

BRIDGE of boats, is a number of common boats joined parallel to each other, at the distance of 6 feet, till they reach across the river; which being covered with strong planks, and fastened with anchors and ropes, the troops march over.

BRIDGE of communication, is that made over a river, by which two armies, or forts, which are

are separated by that river, have a free communication with one another.

Floating-BRIDGE, a bridge made use of in form of a work in fortification called a redout; consisting of two boats, covered with planks, which are solidly framed, so as to bear either horse or artillery. Bridges of this kind are frequently used.

Ponton-BRIDGE, a number of tin or copper boats placed at the distance of 7 or 8 feet asunder, each fastened with an anchor, or a strong rope that goes across the river, running through the rings of the pontons. They are covered with baulks, and then with chests or planks, for the army to march over. See **PONTON**.

Cask, or **Barrel-BRIDGE**, a number of empty casks that support baulks and planks, made as above into a bridge, where pontons, &c. are wanting. Experience has taught us that 5 tun of empty casks will support above water 9000 pounds: hence any calculation may be made.

BRIDGE, in *gunnery*, the two pieces of timber which go between the two transoms of a gun-carriage, on which the coils are placed, for elevating the piece. See **CARRIAGE**.

BRIGADE, in *military affairs*, implies a party, or division of a body of soldiers, whether horse, foot, or artillery, under the command of a brigadier. There are, properly speaking, three sorts of brigades, viz. the brigade of an army, the brigade of a troop of horse, and the brigade of artillery. A brigade of the army is either foot or dragoons, whose exact number is not fixed, but generally consists of 3 regiments, or 6 battalions: a brigade of horse may consist of 8, 10, or 12 squadrons; and that of artillery, of 8 or 10 pieces of cannon, with all their appurtenances. The eldest brigade takes the right of the first line, the second of the second line, and the rest in order, the youngest always possessing the centre. The cavalry and artillery observe the same order. The troops of horse-guards in England are divided into several brigades, according to their strength.

BRIGADE-Major, an officer appointed by the brigadier, to assist him in the management of his brigade. The most experienced captains are generally nominated to this post; who act in the brigade as major-generals do in the armies, receiving their orders from their commanders.

BRIGADIER, a military officer, whose rank is the next above that of a colonel; appointed to command a corps, consisting of several battalions or regiments, called a brigade. This

title in England is suppressed in time of peace, but revived in actual service in the field. Every brigadier marches at the head of his brigade upon duty. The brigadier of foot commands him of horse in garrison; and the brigadier of horse, him of foot in the field. Brigadiers of the horse-guards command as youngest captains of horse, who have generally some higher rank in the army.

BRINGERS up, an antiquated military expression, to signify the whole rear rank of a battalion drawn up, as being the hindmost men of every file.

BRISURE, in *fortification*, is a line of 4 or 5 fathom, which is allowed to the curtain and orillon, to make the hollow tower, or to cover the concealed flank.

BROADSIDE, in a *sea-fight*, implies the discharge of all the artillery on one side of a ship of war.

BROAD-SWORD. See **SWORD**.

BUCCANEERS, in *military history*, a name frequently applied to those famous adventurers, consisting of pirates, &c. from all the maritime nations of Europe, who formerly joined together, and made war upon the Spaniards in America.

BUCKLER, a piece of defensive armour used by the ancients, and worn on the left arm.

BUDGE-Barrels. See **BARREL**.

BUFF-Leather, in *military accoutrements*, is a sort of leather prepared from the buffalo, which, dressed with oil, after the manner of shamoy, makes what is generally called buff-skin. Troopers coulets, shoulder-belts, and sword-belts, are made of this leather. The flaps or covers to the grenadiers pouches, and to those of the artillery, are made of this kind of leather.

BULLETS, are leaden balls, wherewith all kinds of small fire-arms are loaded. The diameter of any bullet is found, by dividing 1.6706 by the cube root of the number, which shews how many of them make a pound; or it may be done in a shorter way. From the logarithm .2228756 of 1.6706 subtract continually the third part of the logarithm of the number of bullets in the pound, and the difference will be the logarithm of the diameter required.

Thus the diameter of a bullet, whereof 12 weigh a pound, is found by subtracting .3597270, a third part of the logarithm of 12, from the given logarithm .2228756, or, when the logarithm is less than the former, an unit must be added, so as to have 1.2228756, and the difference .8631486 will be the logarithm of the diameter

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diameter sought, which is .7297 inches; observing that the number found will always be a decimal, when the logarithm, which is to be subtracted, is greater than that of one pound; because the divisor is greater than the dividend in this case.

Hence, from the specific gravity of lead, the diameter of any bullet may be found from its given weight: for, since a cube foot weighs 11325 ounces, and 678 is to 355 as the cube 1728 of a foot, or 12 inches, is the content of the sphere, which therefore is 5929.7 ounces; and since spheres are as the cubes of their diameters; the weight 5929.7 is to 16 ounces, or 1 pound, as the cube 1728 is to the cube of the diameter of a sphere which weighs a pound; which cube therefore is 4.66263, and its root 1.6706 inches, the diameter sought.

Hence, the following table of leaden bullets from 1 to 39 in the pound is calculated.

	0	1	2	3	4	5	6	7	8	9
0	0	1.671	1.326	1.158	1.05	.977	.919	.873	.835	.803
1	.715	.751	.730	.711	.693	.677	.663	.650	.637	.626
2	.615	.605	.596	.587	.579	.571	.564	.557	.550	.544
3	.538	.532	.526	.521	.517	.511	.506	.501	.497	.493

The diameter of musket bullets differs but 1-50th part from that of the musket bore; for if the shot but just rolls into the barrel, it is sufficient. Government allows 11 bullets in the pound for the proof of muskets, and 14 in the pound, or 29 in two pounds, for service; 17 for the proof of carbines, and 20 for service; and 28 in the pound for the proof of pistols, and 34 for service.

BULWARK, the ancient name for bastion or rampart, which words see.

BURDEN, } in a *general sense*, implies a
BURTHEN, } load or weight, supposed to be as much as a man, horse, &c. can well carry. A sound healthful man can raise a weight equal to his own, can also draw and carry 50lb. a moderate distance. An able horse can draw 350lb. though in length of time 300 is sufficient. Hence all artillery calculations are made. One horse will draw as much as 7 men, and 7 oxen will draw as much as 11 or 12 horses.

BURIALS, as practised by the military, are as follow, viz. The funeral of a field-marshal shall be saluted with 3 rounds of 15 pieces of

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cannon, attended by 6 battalions, and 8 squadrons.

That of a general, with 3 rounds of 11 pieces of cannon, 4 battalions, and 6 squadrons.

That of a lieutenant-general, with 3 rounds of 9 pieces of cannon, 3 battalions, and 4 squadrons.

That of a major-general, with 3 rounds of 7 pieces of cannon, 2 battalions, and 3 squadrons.

That of a colonel, by his own battalion, or an equal number by detachment, with 3 rounds of small arms.

That of a lieutenant-colonel, by 300 men and officers, with 3 rounds of small arms.

That of a major, by 200 men and officers, with 3 rounds of small arms.

That of a captain, by his own company, or 70 rank and file, with 3 rounds of small arms.

That of a lieutenant, by 1 lieutenant, 1 serjeant, 1 drummer, 1 fifer, and 36 rank and file, with 3 rounds.

That of an ensign, by an ensign, a serjeant, and drummer, and 27 rank and file, with 3 rounds.

That of a serjeant, by a serjeant, and 19 rank and file, with 3 rounds of small arms.

That of a corporal, musician, private man, drummer, and fife, by one serjeant and 13 rank and file, with three rounds of small arms.

All officers, attending the funerals of even their nearest relations, shall notwithstanding wear their regimentals, and only have a black crape round their left arm.

The pall to be supported by officers of the same rank with that of the deceased: if the number cannot be had, officers next in seniority are to supply their place.

BURR, in *gunnery*, a round iron ring which serves to rivet the end of the bolt, so as to form a round head like that of a bolt. See **CARRIAGE**.

BUSKINS, a kind of shoe, or half boot, adapted to either foot; formerly a part of the Roman dress, particularly for tragic actors on the stage. They are now much worn by the army.

BUTTON, in *gunnery*, a part of the cascade, in either a gun or howitzer, and is the hind part of the piece, made round in the form of a ball. See **CANNON**.

BUTT, in *gunnery*, is a solid earthen parapet to fire against in the proving of guns, or in practice.

BUTTRESS. See **COUNTERFORT**.

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C A D

CADENCE, in *tactics*, implies a very regular and uniform method of marching, by the drum and music, beating time : it may not be improperly called mathematical marching ; for after the length of the step is determined, the time and distance may be found. It is by a continual practice and attention to this, that the Prussians have arrived at that point of perfection, so much admired in their evolutions.

CADET, among the military, implies a young gentleman who applies himself to the study of fortification and gunnery, &c. and who sometimes serves in the army, with or without pay, 'till a vacancy happens for his promotion. There is a company of gentlemen cadets maintained at Woolwich, at the king's expence, where they are taught all the sciences necessary to form a complete officer. Their number is 48, and commissions are given to them when qualified. The proper signification of the word is, younger brother. See **ACADEMY**.

CÆSTUS, in *military antiquity*, was a large gauntlet, composed of raw hides, used by wrestlers at the public games.

CAISSON, in *military affairs*, is a wooden frame or chest, made square, the side planks about 2 inches thick : it may be made to contain from 4 to 20 loaded shells, according to the execution they are to do, or as the ground is firmer or looser. The sides must be high enough, that when the cover is nailed on, the fuzes may not be damaged. *Caissons* are buried under ground at the depth of 5 or 6 feet, under some work the enemy intends to possess himself of ; and when matter of it, fire is put to the train conveyed through a pipe, which inflames the shells, and blows up the assailants. Sometimes a quantity of loose powder is put into the chest, on which the shells are placed, sufficient to put them in motion, and raise them above ground : at the same time that blast of powder sets fire to the fuze in the shells, which must be calculated to burn from 1 to 2½ seconds. When no powder is put under the shells, a small quantity of mealed powder must be strewed over them, having a communication with the saucisson, in order to convey the fire to the fuzes.

CAISSON, as in some old *military books*, is a covered waggon, to carry bread or ammunition.

CALCULATION, in *military affairs*, is the

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art of computing the amplitudes of shells, time of flight, projectile curve, velocity of shots, charges of mines, &c. together with the necessary tables for practice.

CALIBER, in *gunnery*, signifies the same as their bore or opening ; and the diameter of the bore is called the diameter of its caliber. This expression regards all pieces of artillery.

CALIBER-Compasses, } the name of a parti-
CALLIPER-Compasses, } cular instrument used by gunners, for measuring the diameters of shot, shells, &c. as also the cylinder of cannon, mortars, and howitzers. They resemble other compasses, except in their legs, which are arched, in order that the points may touch the extremities of the arch. To find the true diameter of a circle, they have a quadrant fastened to one leg, and passing through the other, marked with inches and parts, to express the diameter required : the length of each ruler or plate is usually between the limits of 6 inches and a foot. On these rulers are a variety of scales, tables, proportions, &c. such as are esteemed useful to be known by gunners. The following articles are on the completest gunners-callipers, viz. 1. The measure of convex diameters in inches. 2. Of concave ditto. 3. The weight of iron shot from given diameters. 4. The weight of iron shot for given gun bores. 5. The degrees of a semicircle. 6. The proportion of troy and averdupoise weight. 7. The proportion of English and French feet and pounds. 8. Factors used in circular and spherical figures. 9. Tables of the specific gravity and weights of bodies. 10. Tables of the quantity of powder necessary for proof and service of brass and iron guns. 11. Rules for computing the number of shot or shells in a finished pile. 12. Rule concerning the fall of heavy bodies. 13. Rules for raising of water. 14. Rules for firing artillery and mortars. 15. A line of inches. 16. Logarithmic scales of numbers, sines, versed sines and tangents. 17. A sectoral line of equal parts, or the line of lines. 18. A sectoral line of plans and superficies. 19. A sectoral line of solids.

CALQUING, } the art of tracing any kind
CALKING, } of a military drawing, &c. upon some plate, paper, &c. It is performed by covering the backside of the drawing with a black or red colour, and fixing the side so covered upon a piece of paper, waxed plate, &c. This done, every line in the drawing is to be traced

traced over with a point, by which means all the outlines of the drawing will be transferred to the paper or plate, &c.

CALTROPS, in *military affairs*, is a piece of iron having 4 points, all disposed in a triangular form; so that 3 of them always rest upon the ground, and the 4th stands upwards in a perpendicular direction. Each point is 3 or 4 inches long. They are scattered over the ground and passages where the enemy is expected to march, especially the cavalry, in order to embarrass their progress.

CAMISADE, in *military transactions*, implies an attack by surprise, either during the night, or at break of day, when the enemy is supposed to be asleep.

CAMOUFLÉT, in *war*, a kind of flinking combustibles blown out of paper cases, into the miners faces, when they are at work in the galleries of the countermines.

CAMP, in *military affairs*, is the whole extent of ground, in general, occupied by an army pitching its tents when in the field, and upon which all its baggage and apparatus are lodged. It is marked out by the quarter-master-general, who allots every regiment its ground. The extent of the front of a regiment of infantry is 200 yards, including the two battalion guns, and depth 320, when the regiment contains 9 companies, each of 100 private men, and the companies tents stand in one row; but when the companies tents stand in one row, and but 70 private men to each row, the front is then but 155 yards. A squadron of horse has 120 yards in front, and 100 for an interval between each regiment.

The nature of the ground must also be consulted, both for defence against the enemy, and supplies for the army. It should have a communication with their own garrisons, and have plenty of water, forage, and fuel, and either rivers, marshes, hills, or woods to cover it. An army always encamps fronting the enemy, and generally in two parallel lines, besides a corps de reserve, about 500 yards distant from each other: the horse and dragoons on the wings, and the foot in the centre. Where, and how the train of artillery is encamped, see *Park of artillery*, and *Encampment of a regiment of artillery*, under the word *Artillery*. Each regiment posts a subaltern's guard at 80 yards from the colours to the officers tent, called the *quarter-guard*, besides a corporal's guard in the rear: and each regiment of horse or dragoons, a small guard on foot, called the *standard-guard*, at the same distance. The grand guard of the army

consists of horse, and is posted about a mile distant towards the enemy.

In a siege, the *camp* is placed all along the line of circumvallation, or rather in the rear of the approaches, out of cannon-shot: the army faces the circumvallation, if any; that is, the soldiers have the town in their rear.

One thing very essential in the establishing a *camp*, and which should be particularly attended to, if the enemy is near; is, that there should not only be a commodious spot of ground at the head of the camp, where the army, in case of surprise, may in a moment be under arms, and in a condition to repulse the enemy; but also a convenient field of battle at a small distance, and of a sufficient extent for them to form in advantageously, and move with facility. See Pl. VIII. and IX.

CAMP-Utensils, in war time, are hatchets, shovels, mattocks, blankets, camp-kettles, canteens, tents, poles and pins: that is, each company has 10 shovels, and 5 mattocks; each tent 1 hatchet, 2 blankets, 1 camp-kettle, with its linen bag; and each soldier 1 canteen and a knapsack.

CAMP-Colour-men. Each regiment has generally 6, and sometimes 1 per company: they always march with the quarter-master, to assist in making the necessary preparations against the arrival of the regiment in a new encampment. They likewise carry the camp-colours.

Flying-CAMP, or army, is generally meant a strong body of horse and foot, commanded for the most part by a lieutenant-general, which is always in motion, both to cover its own garrisons, and to keep the enemy's army in a continual alarm. It also signifies the ground on which such a body of men encamps.

CAMPAIGN, in *military affairs*, the time every year that an army continues in the field, in war time. We also say, a man as served so many campaigns, i. e. years; the campaign will begin at such a time, this will be a long campaign, &c. The word is also used for an open country before any towns, &c.

CANNON, in the *military art*, implies a tube of brass or iron; they are charged with powder and ball, or sometimes cartridges, grape, and tin-shot, &c. The length is distinguished by three parts; the first re-inforce, the second re-inforce, and the chace: the first re-inforce is 2-7ths, and the second 1-7th and a half of the diameter of the shot. The inside hollow, wherein the powder and shot are lodged, is called the bore, &c. See Plate VI. where every part is mentioned.

History of CANNON. They were originally made of iron bars folded together, and fortified with strong iron hoops; some of which are still to be seen, viz. one in the tower of London, two at Woolwich, and one in the royal arsenal at Lisbon. Others were made of thin sheets of iron rolled up together, and hooped; and on emergencies they were made of leather, with plates of iron or copper. These pieces were made in a rude and imperfect manner, like the first essays of many new inventions. Stone balls were thrown out of these cannon, and a small quantity of powder used on account of their weakness. These pieces have no ornaments, were placed on their carriages by rings, and are of cylindrical form. When or by whom they were made, is uncertain; however, we read of *cannon* being used as early as the 13th century, in a sea engagement between the king of Tunis and the Moorish king of Seville. The Venetians used *cannon* at the siege of Claudia Jessa, now called Chioggia, in 1366, which were brought thither by two Germans, with some powder and leaden balls; as likewise in their wars with the Genoese in 1379. Our glorious king Edward III. made use of *cannon* at the battle of Cressy in 1346, and at the siege of Calais in 1347. *Cannon* were made use of by the Turks at the siege of Constantinople, then in possession of the Christians, in 1394, or in that of 1452, that threw a weight of 500lb. but they generally burst, either the first, second, or third shot. Louis XII. had one cast at Tours, of the same size, which threw a ball from the Bastille to Charenton. One of those famous *cannon* was taken at the siege of Dieu in 1546, by Don John de Castro, and is in the castle of St. Juiliao da Barra, 10 miles from Lisbon; its length is 20 feet 7 inches, diameter at the centre 6 feet 3 inches, and discharges a ball of 100lb. It has neither dolphins, rings, nor button, is of a curious kind of metal, and has a large Indian inscription upon it, which says it was cast in 1400.

CANNON { *Ball.* See BALLS.
 { *Shot.* See SHOT.

To CANNONADE, in war, is to make a very respectable fire out of the great guns.

CANNONIER, the person who manages the guns. See GUNNER.

Ancient and present names of CANNON. Formerly they were dignified with uncommon names; for in 1503 Louis XII. had 12 brass cannon cast, of an uncommon size, called after the names of the 12 peers of France. The Spanish and Portuguese called them after their

saints. The emperor, Charles V. when he marched before Tunis, founded the 12 Apostles. At Milan there is a 70-pounder, called the Pimontelle; and one at Bois-le-duc, called the Devil. A 60-pounder at Dover castle, called Queen Elizabeth's Pocket-pistol. An 80-pounder in the tower of London (formerly in Sterling castle) called Mounts-meg. An 80-pounder in the royal arsenal at Berlin, called the Thunderer. An 80-pounder at Malaga, called the Terrible. Two curious 60-pounders in the arsenal at Bremen, called the Messengers of bad news. And lastly, an uncommon 70-pounder in the castle of St. Angelo at Rome, made of the nails that fastened the copper plates which covered the ancient Pantheon, with this inscription upon it: *Ex clavibus trabalibus porticus scripta.*

In the beginning of the 15th century these uncommon names were generally abolished, and the following more universal ones took place, viz.

	Pounders.	Cwt.
Cannon royal, or carthoun	= 48	about 90
Bastard cannon, or $\frac{1}{4}$ carthoun	= 36	79
$\frac{1}{2}$ carthoun	= 24	60
Whole culverins	= 18	50
Demy culverins	= 9	30
Falcon	= 6	25
Saker { lowest fort	= 6	13
{ ordinary	= 5	15
{ largest size	= 8	18
Basilisk	= 48	85
Serpentine	= 4	8
Aspik	= 2	7
Dragon	= 6	12
Syren	= 60	81
Falconet	= 3, 2, & 1	15, 10, 5

Moyens, which carried a ball of 10 or 12 ounces, &c.

Rabinet, which carried a ball of 16 ounces.

These curious names of beasts and birds of prey were adopted, on account of their swiftness in motion, or of their cruelty; as the *falconet*, *falcon*, *saker*, and *culvering*, &c. for their swiftness in flying; the *basilisk*, *serpentine*, *aspik*, *dragon*, *syren*, &c. for their cruelty. See the Latin poet Forcastarius.

At present *cannon* take their names from the weight of the ball they discharge: thus a piece that discharges a ball of 24 pounds, is called a 24-pounder; one that carries a ball of 12 pounds, is called a 12-pounder; and so of the rest, divided into the following sorts, viz.

Ship-

C A N

Ship-guns, consisting in 42, 36, 32, 24, 18, 12, 9, 6, and 3 pounders.

Garrison-guns, in 42, 32, 24, 18, 12, 9 and 6 pounders.

Battering-guns, in 24, 18, and 12 pounders.

Field-pieces, in 12, 9, 6, 3, 2, 1½, 1, and ½ pounders, whose dimensions are explained in the following tables, except the small pieces, which differ in length and weight, viz.

TABLE of Ship-guns, settled in 1753.

Brass Ship-guns.			Iron Ship-guns.		
Cali-ber.	Len-gth.	Weight.	Cali-ber.	Len-gth.	Weight.
42	9 6	61 2 10	42	10 0	55 1 12
32	9 5	55 2 7	32	9 6	53 3 23
24	9 5	51 1 12	24	9 5	48 0 0
18	9 0	48 1 0	18	9 0	41 1 8
12	9 0	29 0 0	12	9 0	32 3 3
9	8 5	26 0 0	9	8 5	23 2 2
6	8 0	19 0 0	6	7 0	17 1 14
3	6 5	11 0 0	4	6 0	12 2 13
			3	4 6	7 1 7

N. B. The length is expressed in feet and inches, and the weight in centres, quarters, and pounds.

TABLE of Garrison-pieces.

Brass Garrison-pieces.			Iron Garrison-pieces.		
Cali-ber.	Len-gth.	Weight.	Cali-ber.	Len-gth.	Weight.
42	10 0	64 0 0	32	9 8	56 0 0
32	9 2	49 2 18	24	9 8	48 0 0
24	8 4	37 0 0	18	9 0	36 0 0
18	7 6	27 3 0	12	7 8	24 0 0
12	6 7	18 2 0	9	7 0	18 0 0
9	6 0	13 3 0	6	6 1	12 0 0
6	5 3	9 1 0	4	5 4	8 0 0

C A N

Brass Battering-pieces.

Brass Field-pieces.

New pieces.			New pieces.		
Cali-ber.	Len-gth.	Weight.	Cali-ber.	Len-gth.	Weight.
24	9 8	27 0 0	12	5 0	8 3 8
18	9 0	20 1 0	6	4 6	4 3 10
12	7 8	13 2 0	3	3 6	2 3 10

The metal of which brass cannon are made, is in a manner kept a secret by the founders; yet, with all their art and secrecy, they have not hitherto found out a composition that will stand a hot engagement without melting, or at least being rendered useless. Those cast at Woolwich bid fairest towards this amendment. The respective quantities which should enter into this composition, is a point not decided; every founder has his own proportions, which are peculiar to himself. The most common proportions of the ingredients are the following, viz. To 240 lb. of metal fit for casting, they put 68 lb. of copper, 52 lb. of brass, and 12 lb. of tin. To 4200 lb. of metal fit for casting, the Germans put 3687½ lb. of copper, 204½ lb. of brass, and 307½ lb. of tin. Others again use 100 lb. of copper, 6 lb. of brass, and 9 lb. of tin; and lastly, others 100 lb. of copper, 10 lb. of brass, and 15 lb. of tin. With respect to iron guns, their structure is the same as that of the others, and they generally stand the most severe engagements, being frequently used on ship-board. Several experiments have taught us that the Swedish iron guns are preferable to all others.

CANNON is now generally cast solid, and the cavity bored afterwards by a very curious machine for that purpose, where the gun is placed in a perpendicular position; but of late these machines have been made to bore horizontally, and much truer than those that bore in a vertical form. This new machine was first invented at Strasburg, and greatly improved by Mr. Verbruggen, a Dutchman, at present head founder at the royal foundry at Woolwich, where probably the best horizontal-boring machine in Europe has been lately fixed; it both bores the inside, and turns and polishes the outside at once.

Names of the several parts of a CANNON. See Plate VI.

The grand divisions exterior, are as follow, viz. First re-inforce, is that part of a gun next the breech, which is made stronger, to resist the force of powder.

C A N

Second re-inforce. This begins where the first ends, and is made something smaller than the first.

The chace, is all that part from the trunnions to the muzzle.

The muzzle, properly so called, is the part from the muzzle astragal to the end of the piece.

Small divisions exterior.

The cascable, the hindmost part of the breech, from the base-ring to the end of the button.

The cascable-astragal, is that diminishing part between the two breech-mouldings.

The neck of the cascable, is that narrow space between the breech-moulding and the button.

The breech, is that solid piece of metal behind, between the vent and the extremity of the base-ring, and which terminates the hind part of the gun, exclusive of the cascable.

The breech-mouldings, are those eminent parts, as squares or rounds, which serve only for ornaments to the piece, &c.

The base-ring and ogee, are ornamental mouldings: the latter is always in the shape of an S, taken from civil architecture, and used in guns, mortars, and howitzers.

The vent-field, is the part from the vent to the first re-inforce astragal.

The vent astragal and fillets, are the mouldings and fillets at or near the vent.

The charging cylinder, is all the space from the chace-astragal to the muzzle-astragal.

The first re-inforce ring and ogee, is the ornament on the second re-inforce.

The first re-inforce astragal, is the ornament between the first and second re-inforce.

The chase-girdle, is the ornament close to the trunnions.

The trunnions, are two solid cylindrical pieces of metal in every gun, which project the piece, and by which it is supported upon its carriage.

The dolphins, are the two handles placed on the second re-inforce ring of brass guns, resembling the fish of that name: they serve for mounting and dismounting the guns.

The second re-inforce ring and ogee, are the two ornaments joining the trunnions.

The second reinforce-astragal, is the moulding nearest the trunnions.

The chase-astragal and fillets, the two last-mentioned ornaments jointly.

The muzzle-astragal and fillets, the joint ornaments nearest the muzzle.

The muzzle-mouldings, the ornaments at the very muzzle of the piece.

The swelling of the muzzle, the projected part behind the muzzle-mouldings.

C A N

Interior parts.

The mouth, or entrance of the bore, is that part where both powder and ball are put in, or the hollow part which receives the charge.

The vent, in all kinds of fire-arms, is vulgarly called the touch-hole: it is a small hole pierced at the end, or near it, of the bore or chamber, to prime the piece with powder, or to introduce the tube, in order, when lighted, to set fire to the charge.

The chamber, which is only in large calibres, is the place where the powder is lodged, which forms the charge.

Tools for loading and firing CANNON, are rammers, sponges, ladles, worms, hand-spikes, wedges, and screws.

Coins, or wedges, to lay under the breech of the gun, in order to elevate or depress it.

Hand-spikes, serve to move and to lay the gun.

Ladles, serve to load the gun with loose powder.

Rammers, are cylinders of wood, whose diameters and axes are equal to those of the shot: they serve to ram home the wads put upon the powder and shot.

Sponge, is fixed at the opposite end of the rammer, covered with lamb-skin, and serves to clean the gun when fired.

Screws, are used to field-pieces, instead of coins, by which the gun is kept to the same elevation.

Tools necessary for proving CANNON, are, a searcher with a reliever, and a searcher with one point.

Searcher, is an iron, hollow at one end to receive a wooden handle, and on the other end has from 4 to 8 flat springs of about 8 or 10 inches long, pointed and turned outwards at the ends.

The Reliever, is an iron flat ring, with a wooden handle, at right angles to it. When a gun is to be searched after it has been fired, this searcher is introduced and turned every way, from end to end; and if there is any hole, the point of one or other of the springs gets into it, and remains 'till the reliever, passing round the handle of the searcher, pressing the springs together, relieves it.

When there is any hole or roughness in the gun, the distance from the mouth is marked on the outside with chalk.

The other searcher has also a wooden handle, and a point at the fore end, of about an inch long, at right angles to the length: about this point is put some wax, mixed with tallow, which, when introduced into the hole or cavity, is pressed

C A N

pressed in, when the impression upon the wax gives the depth, and the length is known by the motion of the searher backwards and forwards: if a hole is $\frac{1}{4}$ of an inch deep, the gun is rejected. See INSTRUMENTS.

C A P

Charges for all the different pieces, and on all occasions, in garrison and the field.

In order to render this difficult article visible on speculation, I have formed the following table. See PROOF.

Calib.	Proof.		Service.		Saluting.	Ricochet.	Diameter of		Length of cart.	
	Brafs.	Iron.	Brafs.	Iron.			Guns.	Shot.	Proof.	Service.
pds.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	ln. pts.	ln. pts.	ln. pts.	ln. pts.
42	31 8	25	14	12	10 4	4 7	7 018	6 684	26 94	17 79
32	26 12	21 8	10 10	9 4	8	2 12	6 410	6 105	26 3	16 25
24	21	18	8	8	6	2	5 824	5 547	25 58	14 78
18	18	15	6	8	4 8	1 12	5 292	5 040	24 92	13 46
12	12	12	4	4	3	1 6	4 623	4 403	23 24	11 72
9	9	9	3	3	2 8	1 4	4 200	4	21 26	10 63
6	6	6	2 8	2 8	2	1	3 608	3 498	18 7	9 35
4	4	4	1 6	1 8	1 4	12	3 204	3 003	16 43	8 12
3	3	3	1	1	12	8	2 913	2 775	14 84	7 42
12	1 8	1 8	8	8	6	4	2 031	2 020	11 76	5 88
1	1	1	5	5	4	2 1	2 016	1 923	8 35	3 18

The price of artillery.

The government pays 130l. per ton for brafs cannon, 12l. for each horse; and a fixed price is allowed for carriages, wheels, iron-work, tumbrils, ammunition, and ball. For cannon ball the government allows 16l. per ton, and 8l. 8s. per quintal for gunpowder. Hence a 24-pounder, with all its appurtenances, ready to act against an enemy, stands the government in 324l. 19s. 5½d. a 12-pounder, in 208l. 10s. 6d. and a 6-pounder, in 119l. 14s. 6½d.

CANNON-Baskets. See GABIONS.

70 nail CANNON. See NAIL.

CANTEENS, in *military articles*, implies a tin vessel used by the soldiers on a march, &c. to carry water or other drinkables in, and holds about 2 quarts.

CANTONMENTS, in *military affairs*, is the quartering the army as near to each other as possible, and in the same manner they incamped in the field. The chief reasons for cantoning an army are, first, when the campaign begins early; on which occasion, in cantoning your troops, two objects demand attention, viz. the military object, and that of subsistence: the 2d is, when an army has finished a siege early, the troops are allowed to repose till the fields produce forage for their subsistence: the 3d reason is, when the autumn proves rainy, and forage scarce, the troops are cantoned to protect them from the bad weather.

CANVAS-Bags. See BAGS, Sand-BAGS, &c.

CAPS, in *gunnery*, are pieces of leather, or more commonly sheep-skins, to cover the mouth of mortars when loaded, till they are fired, to prevent damps, or rain getting in.

CAP-Squares. See CARRIAGES.

CAPITAL, in *fortification*, is an imaginary line which divides any work into two equal and similar parts. It signifies also, a line drawn from the angle of a polygon to the point of the bastion, or from the point of the bastion to the middle of the gorge.

CAPITULATION, in *military affairs*, implies the conditions on which the garrison of a place besieged agree to deliver it up, &c. This is likewise the last action, both in the attack and defence of a fortification, the conditions of which may be of various kinds, according to the different circumstances or situations in which they are.

As soon as the capitulation is agreed on, and signed, hostages are generally delivered on both sides, for the exact performance of the articles; part of the place is delivered to the besiegers, and a day appointed for the garrison to evacuate the place. The usual and most honourable conditions are, with arms and baggage, drums beating, and colours flying, matches lighted, and some pieces of artillery; waggons, and convoys for the baggage, sick and wounded, &c.

CAPONIER, in *fortification*, is a passage made from one work to another, of 10 or 12 feet wide, and about 5 feet deep, covered on each

each side by a parapet, terminating in a glacis. Sometimes they are covered with planks and earth. See FORTIFICATION.

CAPSTERN, } in *military mechanics*, signifies
CAPSTAN, } a strong massy piece of timber in the form of a truncated cone, and having its upper part, called the drum-head, pierced with a number of square holes, for receiving the levers; and by turning it round, several actions may be performed that require an extraordinary power.

CAPTAIN, in *military affairs*, is a military officer, who is the commander in chief of a company of foot, artillery, horse, or dragoons. The name of captain was the first term made use of to express the chief or head of a company, troop, or body of men. He is both to march and fight at the head of his company. A captain of artillery and engineers ought to be more a master of the attack and defence of fortified places than either a captain of infantry or cavalry; because they must be good mathematicians, and understand the raising of all kinds of batteries, to open the trenches, to conduct the sap, to make mines and soubasles, and to calculate their charges. They ought further to be well acquainted with the power of artillery, the doctrine of the military projectile, and the laws of motion, together with the system of mechanics; and should be good draughtsmen. A captain has in most services the power of appointing his own serjeants and corporals, but cannot by his own authority break them; neither can he punish a soldier with death, unless he revolts against him on duty. Among the horse, when captains of several regiments meet, he that has the eldest commission takes place and commands; but among the foot, the captain of the eldest regiment commands all that are of younger regiments, though they have elder commissions. The same denomination is given to him that commands a ship of war, or the like. Captains of the guards in the English service rank as colonels in marching regiments; the captains of artillery in the Prussian service rank as majors in the army, and have an extraordinary pay, on account of the great qualifications that monarch demands of them; and the captains of bombardiers, miners, and artificers, in the Portuguese service, have 3l. 7s. 6d. a month more than the captains of artillery in the same regiment.

CAPTAIN-*Lieutenant*, the commanding officer of the colonel's company or troop in every regiment. He commands as youngest captain, though in reality he is only the first lieutenant, the colonel being himself captain. This de-

nomination was abolished in the English army in 1772, when it was ordered that for the future all captain-lieutenants should have the rank and title of captains in the army. This title is still used in all foreign services.

CAPITAINE *en pied*, or captain in pay, one who is not reformed, but keeps in full pay, and exempt from duty. This expression occurs sometimes in history.

CAPTAIN *reformed*, one who, upon reducing the forces on the termination of war, loses his company, yet keeps his rank and pay, whether on duty or not.

CAPTAIN *on half pay*, is one who loses his company on the reduction of an army, and retires on half-pay, until seniority puts him into duty and full pay again.

CAPTAIN *en second*, or second captain, is one whose company has been broke, and who is joined to another, to serve under the captain of it. This is customary in France, but not in England.

CAPITAINE *des gardes*, or captain of the guards, is the captain of a company in any of the regiments of guards.

CAP-A-PEE, in *military antiquity*, implies being clothed in armour from head to foot.

CARABINE, in *military affairs*, is a fire-arm somewhat smaller than the firelocks of the infantry, and used by all the horse. It carries a ball of 24 in the pound: its barrel is 3 feet long, and the whole length, including the stock, 4 feet.

Rifled-CARABINES, are generally of the same dimensions with the above, the barrel of which is rifled spirally from the breech to the mouth, so that when the ball, which is forced into it, is driven out again by the strength of the powder, it is lengthened about the breadth of a finger, and marked with the rifle of the bore. Fire-arms of this kind have a much greater range than any other, because the rifle of the barrel impedes the ball, which by that means makes the greater resistance at the first inflammation of the powder, giving time for the whole charge to take fire, before the ball is out of the bore. These arms are used by the hunters, or light infantry.

CARABINEERS, or *Carabineers*. All regiments of light-armed horse were formerly called so; but since the forming of hussars and chasseurs, they have lost that denomination; and now all the foreign heavy cavalry are called carabineers.

CARCASS, in *military affairs*, are of two sorts, oblong and round: the uncertain flight of the first sort has almost rendered them useless.

C A R

lefts. They are prepared in the following manner: boil 12 or 15 lb. of pitch in a glazed earthen pot; mix with that 3 lb. of tallow, 30 lb. of powder, 6 lb. of salt-petre, and as many stopins as can be put in. Before the composition is cold, the carcass must be filled; to do which, line your hands with oil or tallow, and fill the carcass $\frac{1}{4}$ full with the above composition; then put in loaded pieces of gun or pistol barrels, loaded grenades, and the intervals with composition; and cover the whole over with coarse cloth, well sewed together, keeping it in a round form. Then put it into the carcass, having a hollow top and bottom, with bars running between them to hold them together, and composed of 4 slips of iron joined at top, and fixed at the bottom, at equal distances, to a piece of iron, which, together with the hoops, when filled, form a complete globular body. When quite finished and cold, it must be steeped in melted pitch, and then instantly immersed in cold water. Lastly, bore 3 or 4 holes at top, and fill the same with fuze composition, covering the holes with pitch until used. They are thrown out of mortars, and weigh from 50 to

C A R

230 lb. according to the size of the mortars they are thrown out of. There are other carcasses for the sea-service, which differ from a shell only in the composition, and the 4 holes from which it burns when fired.

CARCASSES were first used by the bishop of Munster, at the siege of Groll in 1672, where the duke of Luxembourg commanded.

CARRIAGES, in *military affairs*, are of various kinds, viz.

Garrison-CARRIAGES, are those on which all sorts of garrison pieces are mounted. They are made much shorter than field-carriages, and have generally iron trucks instead of wheels. Their dimensions are all specified in the following table, together with the names of every article thereto belonging. The dimensions are expressed in inches and decimals, except the head column, which is the nature of the gun, from a 42 to a 3-pounder. The arms of the hind axle-tree, having the same dimensions as those of the fore ones, are omitted, as also the height behind the side pieces. See Pl. VI. fig. 2.

Nature of the gun		42	32	24	18	12	9	6	3
Width inclosed	before	18	13	10.5	15.5	14	13	11.5	9
	behind	23.5	23.5	22.5	21.5	19.5	18.5	16.5	12.5
Fore axle-tree length		57	57	54.5	54.5	45.5	42.5	38.8	32.5
Body	length	35.4	36.6	34.9	33.1	29.5	27.5	24.8	19.5
	height	17.8	10.8	10.	10	10	9.5	9.	8.3
	breadth	6.8	6.8	6.8	6	5.5	5.2	5.	4
Arms	length	10.8	10.2	9.8	9.2	8	7.5	7	5.3
	diameter	6.2	6.2	6.2	5.8	5.2	5.	4.5	3.5
Hind axle-tree	length	57	57	54	51.5	45.5	42.5	38.8	32.5
	length	35.4	36.6	34.9	33.1	29.5	27.5	24.8	19.5
	height	6.8	6.8	6.8	6	5.5	5.2	5	4
Body	breadth	12	12	12	12	12	12	12	12.
	diameter	19	19	18	18	16	16	14	14
Fore-trucks	breadth	6.5	6.5	5.5	5	4.5	4	3.5	3
	diameter	16	16	16	15	14	14	12	10.
Hind-trucks	breadth	6.5	6	5.5	5	4.5	4	3.5	3
	height before	26.8	26.2	26.	23.6	20	18.8	16	13.6
Side-pieces	length	78	78	72	69	66	63	60	37.5
	breadth	6.5	6.	5.5	5	4.5	4	3.5	3.
Trunions from the head		8	8	8	8	6.8	6.6	6.6	6

Names of all the iron-work of a garrison-CARRIAGE, together with the quantity of each sort.

Cap-squares	-	-	-	2
Eye-bolts	-	-	-	2
Joint-bolts	-	-	-	2
Transom-bolt	-	-	-	1
Bed-bolt	-	-	-	1
Bracket-bolts	-	-	-	2

Hind axle-tree bolts	-	-	4
Burs	-	-	2
Loops	-	-	6
Dowel-pins	-	-	4
Square riveting-plates	-	-	8
Rings and keys	-	-	10
Traversing-plates	-	-	2
Linch-pins	-	-	4

Axle-

C A R

Axle-tree hoops	-	-	2
Axle-tree stays	-	-	2
Keys, chains, and staples	-	-	2
Stool-bed bolts, &c.	-	-	2

N. B. As the trucks of garrison-carriages are generally made of cast-iron, their axle-trees should have copper clouts underneath, to diminish the friction of the iron against the wood. Travelling-carriages are in many re-

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spects very unfit for garrison service, though frequently used.

Travelling-CARRIAGES, are such as guns are mounted on for sieges, and for the field: they are much longer, and differently constructed from garrison-carriages; having 4 wheels, 2 for the carriage, and 2 for the limber, which last are only used on marches. The names and dimensions of each part are specified in the following tables.

Checks.

Nature of the guns	-	-	-
Length of the checks in feet	-	-	-
Thickness of the checks in inches and decimals	-	-	-
Height of the plank	-	-	-
Height of the check	{ before	-	-
	{ centre	-	-
	{ trail	-	-
Head from the centre	-	-	-
Length of the trail	-	-	-

24	18	12	6	3
13.	12.5	12	11	10
5.8	5.2	4.6	3.6	3.
22	21.6	19	16	13
20	19.6	17	14	11.5
17	16.6	15	10	9.5
12	11.6	11	10	7.5
74	72	69	60	5.5
18	16.6	15	12	10

Of the axle-trees.

Nature of the guns	-	-	-
Body	{ length	-	-
	{ breadth	-	-
	{ height	-	-
Arms	{ length	-	-
	{ body diameter	-	-
	{ linch diameter	-	-
Total length	-	-	-

24	18	12	6	3
38.5	38.8	39.	40	40.5
7	7.8	6.5	6	5.5
9	9.8	8.5	8	7.5
21	20.8	20.5	19	17.5
7	6.8	6.5	6	5.5
5	4.8	4.	4	3.5
81	80.5	80	78	76

Of the wheels.

Calibers, or nature of the guns	-	-	-
Wheels diameter	-	-	-
Nave length	-	-	-
Diameter	{ body	-	-
	{ middle	-	-
	{ linch	-	-
Fellies	{ thickness	-	-
	{ breadth	-	-
Spokes	{ thickness	-	-
	{ breadth	-	-

24	12	6	3	parts
58	58	58	58	
17.5	17	15.5	12.5	76
15	15	13	12.5	62
10	16	14	13	74
13.5	13.5	10	10	60
5	4.5	4	3	12
6.5	6	5.5	5	28
2.3	2.2	2.	2	10
4.5	4	3.5	3	0

N. B. The explanation of this table is as the former, except the last column, which expresses general dimensions, taken from the diameter of the shot, divided into 24 equal parts; a method by which all the dimensions of both guns and carriages should be regulated.

Names and quantity of the iron-work of a Travelling-Carriage.

Transom-bolts, with burs	{ breast	1
	{ centre	2
	{ trail	2

Transom-plates, with hooks	{ breast	2
	{ centre	2
	{ trail	2
Trunnion-plates	—	2
Cap-squares with joint-bolts	—	2
Spring-keys, with chain and staples	—	4
Eye-bolts	{ fore.	2
	{ hind	2
Single forelock keys	—	8
Bed piece, chain and staple	—	1
Locker	{ hinges	2
	{ half with staples	1

Wood

C A R

Wood screws			2
Plates, with roses	{ garnish		2
Breast-plates	{ trail		2
Garnish	{ bolts		2
	{ nails		6
Axle-tree-bands			2
Side-straps			4
Draught-rings, with bolts and burs			2
Locking-plates			2
Lashing rings and loops			8
Nails	{ rose-buds		4
	{ diamond-headed		8
	{ counterfunk		26
	{ trail		2
Pintle-plates			2

Names and quantity of all the parts of a wheel and iron-work.

Nave			1
Spokes			12
Fellies			6
Dowel-pins			6
Streaks			6
Streak-nails			6
Nave-boxes			2
Dowledges			6
Nave-hoop-stubs			9
Box pins			6
Rivets for the dowledges			24
Nave hoops			3

Names and quantity of iron-work of an axle-tree.

Axle-tree-bar			1
Clouts	{ body		2
	{ lynch		2
	{ lynch		2
Axle-tree-hoops	{ arms		2
	{ body		2
Hurters with straps			2
Washers			2
Linch-pins			2
Axle-tree-bolt			1
Single forelocks			2
Clout-nails			12
Dog-nails			8
Axle-tree-hoops			2

N. B. The dimensions of carriage limbers will be mentioned in the article *Field-CARRIAGES*, as they are the same with travelling carriages.

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Field CARRIAGES, are both shorter and lighter than those before mentioned, bearing a proportion to the pieces mounted thereon: the names and dimensions of every part are specified in the following tables. See Pl. VII. fig. 1 and 2.

Calibres	24	12	6	parts
length	108.	106.	94.	13.4
height	15.6	14.	12.4	3.6
thickness	4.5	3.7	3.	0.18
height before	14.5	12.7	11.	2.18
at the centre	12.	10.9	9.8	2.16
at the trail	10.	9.2	8.	1.16
Length of the trail	11.	10.5	10.	1.22
From head to centre	50.	45	40.	11.6
Width	{ before	11.5	10.7	10.
	{ behind	17.	15.	13.
				2.15
Lockers	{ length			23.
	{ breadth			13.3
	{ depth			4.3
Length of the trail				
hand-spike	63.	60.	57.	
Diameter at the trail				
of ditto	4.	3.5	3.	
handles in				
length		5.	4.	
Screw for				
elevation	{ height	10.5	9.	
	{ diameter	2.	1.5	
	{ diameter of			
	{ socket	3.	2.5	
Wheels height	50.	50.	50.	45.
Nave length	15.	13.	12.7	3.
Wheels dia-	{ body	13.	11.	10.6
meter	{ middle	14.	12.	11.6
	{ lynch	12.	11.	10.
				2.5
Fellies	{ height	4.7	4.	3.6
	{ breadth	3.3	2.8	2.4
Spokes	{ breadth	2.	1.8	1.7
	{ thickness	3.5	3.2	2.9
				0.17

Limbers, are two-wheel carriages, sometimes made with shafts, and sometimes with beams for drawing double: they serve to support the trail of *field-carriages*, by means of the pintle or iron bolt, when artillery is transported from one place to another; and are taken off again when the pieces are to be fired, unless upon a march, when harrassed by the enemy, &c. Their construction is in the following tables. See Pl. VII. fig. 3 and 4.

Calibres

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Calibres	-	-	-	-	24	12	6	3	parts
Nave	-	-	-	-	18.	48.	48.	1.	
					16.	15.	14.	10.	
					14.	14.	13.	12.5	2.15
					12.	12.	11.	10.	2.10
Fellies	-	-	-	-	4.5	4.	3.5	3.	0.20
					5.	4.5	4.	3.5	
Spokes	-	-	-	-	1.8	1.6	1.4	1.2	0.9
					4.	3.5	3.	2.5	0.19
Body	-	-	-	-	40.	40.	40.	43.	
					7.6	7.	6.	5.5	
					6.	5.5	5.	5.	
Arms length	-	-	-	-	19.	18.	17.	13.	
Diameters	-	-	-	-	5.	4.	4.	4.	0.23
					4.	3.	3.	3.	0.19
Shafts length	-	-	-	-	94.	94.	94.	94.	
Breadth	-	-	-	-	6.	5.5	5.	4.	1.5
					3.	3.	2.5	2.5	0.15
Height	-	-	-	-	3.3	3.	3.	3.	0.16
					3.	3.	2.5	2.5	0.15
Beams	-	-	-	-	110.	110.	110.	110.	
					4.5	4.	3.5	3.	
					4.	3.5	3.	2.5	
Bolster	-	-	-	-	12.5	10.	8.	7.	
					36.	36.	36.	36.	
					6.	5.5	5.	5.	1.4
Fore cross-bar	-	-	-	-	4.5	4.	3.5	3.	0.20
					1.5	1.5	1.5	1.5	
Hind cross-bar	-	-	-	-	3.5	3.5	3.5	3.5	0.16
					1.5	1.5	1.5	1.5	
Axle-tree from the fore cross-bar	-	-	-	-	11.5	11.5	11.5	11.5	2.1

Names of all the iron-work of the shafts and beams of limbers, with the quantity of each sort.

Limber-bolt	—	—	1
Shaft-rings	—	—	2
Shaft-pins with chains	—	—	2
Ridge-chain hook and loop	—	—	1
Limber-chain hook and rings	—	—	1
Breech-hooks	—	—	2
Single forelock-keys	—	—	4
Nails, diamond-headed	—	—	8
Dog-nails	—	—	6
Bolster-hoops	—	—	2
Pintle	—	—	1
Pintle-washers and plates	—	—	2

N. B. The iron-work of the wheel and axle-tree are the same as mentioned before, under the articles *wheels*, *axle-trees*, and under the general term **CARRIAGES**.

Galleper-CARRIAGES, serve for 14-pounders. These carriages are made with shafts, so as to be drawn without a limber. In the last war the king of Prussia mounted light 3-pounders on these carriages, which answered very well. Their dimensions are

		feet	inch.	part
Total length of the shafts	-	11		27
From the { fore end to the fore cross-bar	-	6	4.	16
		5		11
Height at the { hind end to the round part	-		6.	3.10
			3.	3
Breadth { behind and before	-		3.5	8.15
			4.5	9.
Width within behind	-	2	6.5	7
At the fore { cross-bar	-	2	4.	7.10
		2	1.	7.
From the hind end to the axle-tree	-	11.		5
Cross-bar from the hind end	-	3.		12
Length of the cheeks	-	4	2.	11
Breadth of the fore cheeks	-		2.5	1
Width within { before	-		8.	2
			11.5	1.20
Height of the cheeks	-		6.5	1.15
Total length of the axle-tree	-	6	4.	18
Length of the { body	-	3	6.5	
		1	4.6	
Breadth of the body	-		5.	
Height of ditto	-		6.	
Greatest diameter of the arms	-		5.	
Least diameter of ditto	-		3.3	
Diameter of the wheels	-	4	3.	13.5
Nave length	-	1	1.	4.5
Diameters { body	-		11.	3
				3.5
			10.	2.20
Spokes { breadth	-		1.5	2.20
			3.	1.
Fellies { thickness	-		3.	1.
			4.5	1.10

N. B. The

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N. B. The dimensions, not inserted here, may be taken from the draughts, where they are all mentioned, as likewise the iron-work.

Howitz-CARRIAGES, are for transporting howitzers; and those for the 6 and 5.8-inch howitzers are made with screws to elevate them, in the same manner as the light 6-pounders; for which reason they are made without a bed, and the centre transom must be 9 inches broad to fix the screw, instead of 4 for those made without: in the centre, between the trail and centre-transom, there is a transom-bolt, which is not in others, because the centre-transom must be made to be taken out; after which the howitzer can be elevated to any angle under 90 degrees. Their dimensions are as follow:

Length of the cheeks	-	-	8	5.	6.
Thickness of the cheeks	-	-	-	4.5	3.
Height of the cheeks before	-	-	1	6.	1.8
----- at the centre	-	-	1	4.	1.
----- at the trail	-	-	1	2.	.17
Length of the trail	-	-	1	3.	1.
Height of the plank	-	-	1	6.	-
From the head to the centre	-	-	3	7.	-
Trunnion-holes from the head	-	-	-	9.	.15
Breast-transom	{ length	-	1	2.5	.21
	{ height	-	-	2.	-
	{ thickness	-	-	4.5	.9
Centre-transom	{ length	-	1	4.	1.3
	{ height	-	-	2.5	-
	{ thickness	-	-	4.5	.10
Trail-transom	{ length	-	1	7.	1.5
	{ height	-	1	3.	-
	{ thickness	-	-	4.5	.23

The iron-work of these carriages is the same as in the field-carriages (which see) except that here are only 4 garnish-nails, 2 on each side: the cheeks, being so short, will admit of no more. The wheels and axle-trees are the same as in the 18 and 12-pounder carriages.

Tumbrel-CARRIAGE. See TUMBREL.

Black-CARRIAGE, is purposely for conveying mortars and their beds from one place to another; the dimensions of which are as follow:

Fore-wheel height	-	-	inch.	48
Nave length	-	-	-	15
Diameters	{ body	-	-	14
	{ middle	-	-	15
	{ linc	-	-	13
Fellies	{ height	-	-	5.5
	{ breadth	-	-	3.5
Spokes	{ breadth	-	-	2
	{ thickness	-	-	3

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Hind-wheels height	-	-	inch.	60
Nave length	-	-	-	17
Diameters	{ body	-	-	14
	{ middle	-	-	15
	{ linc	-	-	13
Fellies	{ height	-	-	6.5
	{ breadth	-	-	4
Spokes	{ breadth	-	-	2.3
	{ thickness	-	-	4
Fore axle-tree total length	-	-	-	77
Body	{ length	-	-	39
	{ breadth	-	-	6.5
	{ thickness	-	-	8
Arms length	-	-	-	19
Diameters	{ body	-	-	6
	{ linc	-	-	4
	{ length	-	-	49
Bolster	{ breadth	-	-	6.5
	{ height	-	-	7
Hind axle-tree total length	-	-	-	77
Body	{ length	-	-	37
	{ breadth	-	-	7
	{ height	-	-	8.7
Arms length	-	-	-	20
Diameters	{ body	-	-	6.4
	{ linc	-	-	4.8
	{ length	-	-	47
Bolster	{ breadth	-	-	7
	{ height	-	-	8
Side-pieces	{ length	-	-	13.2
	{ breadth	-	-	6.5
	{ height	-	-	6.5
Distance between the axle-trees	-	-	-	-
Side-pieces project equally by	-	-	-	-
Shafts length	-	-	-	96
Length of the strait-bar	-	-	-	19
Shafts breadth	{ behind	-	-	5.3
	{ middle	-	-	6
	{ before	-	-	3
Opening of the strait bar	{ behind	-	-	28.5
	{ middle	-	-	32.5
	{ before	-	-	24
Height of the shafts	-	-	-	5
Rider	{ length	-	-	46
	{ breadth	-	-	6.5
	{ height	-	-	8
Interval between the side-pieces	-	-	-	12
Side-pieces are let into the rider and	-	-	-	-
hind-bolster.	-	-	-	2

Truck-CARRIAGES, are to carry timber and other heavy burthens from one place to another, at no great distance: they serve also to convey guns or mortars upon a battery, where their own carriages cannot go, and are drawn by men as well as horses. Their dimensions are as follow:

Fore

C A R

			Inch.
Fore axle-tree	body length	-	32
	breadth	-	5
	height	-	11
	arms length	-	6.5
Hind axle-tree	diameter	-	3
	body length	-	32
	breadth	-	6
	height	-	7.5
Side-pieces	arms length	-	6.5
	diameter	-	3
	length	-	100
	breadth	-	10
Fore-bolster	height	-	2.5
	interval	-	10
	to the fore axle-tree	-	15
	to the hind axle-tree	-	15
Hind-bolster	length	-	32
	breadth	-	5
	height	-	6
	length	-	32
Shafts	breadth	-	6
	height	-	8
	length	-	96
	height	-	3.3
Opening	near the bolt	-	23
	middle	-	35
	before	-	24
	before	-	3
Breadth	middle	-	4
	at the bolt	-	3.5
	From the end to the strait cross-bar	-	12
	length	-	30
Fore-guide	breadth	-	21
	height	-	4
	interval	-	10
	diameter	-	23
Trucks	thickness	-	4

The cross piece fixed upon the fore ends of the side pieces, is 5 inches broad, 3 high before, and 1.5 behind. The cross piece behind the fore bolster and the side pieces, is 10 inches broad, and 1.5 thick. The bolsters are let into the side pieces about 3-4ths of an inch. The iron-work is so distinctly seen in the plan and elevation of the carriage, that it would be needless to mention it.

Ponton-CARRIAGE. Carriages of this kind are solely for transporting the pontoons: they had formerly but two wheels, but are generally now made with four. The making use of two-wheel carriages for travelling a great way, is contrary to sense and reason; because the whole weight lying upon the two wheels, must make them sink deeper into the ground, than those of a four-wheel carriage: Their dimensions are as follow:

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			Inch.
Wheels diameter, both behind and before			63
Nave length			15
Diameters	body	-	14
	middle	-	15
	linch	-	12
	breadth	-	4
Fellies	height	-	4.5
	breadth	-	2
Spokes	thickness	-	3.5
	Axle-tree length	-	88
Body	length	-	46
	breadth	-	6
	height	-	2.5
Arms length			18
Diameter	body	-	6
	length	-	3.8
Side-pieces	under	-	210
	upper	-	205
Under side-pieces	breadth	-	7
	height	-	6
Upper side-pieces	breadth	-	5
	height	-	2.6
Fore and hind cross-bars	breadth	-	6.5
	height	-	3.5
	length	-	52
Centre of the fore axle-tree distant from the fore end			10
Centre of the hind axle-tree distant from the hind end			93
Opening between the	upper side-pieces	-	51
	under side-pieces	-	18
Fore supporter, distant from the fore end			45
Hind supporter, distant from the hind end			77
Height of the supporters			11

CAROUSAL, in *military history*, signifies a magnificent entertainment, exhibited by princes or other great personages, on some public occasion; consisting of cavalcades of gentlemen richly dressed and equipped, after the manner of the ancient cavaliers divided into squadrons, meeting in some public place, and performing jests, tournaments, &c.

To CARRY on the trenches. See TRENCHES.

CART, in a *military sense*, is a vehicle mounted on two wheels, and drawn by one or more horses; of which there are several sorts, viz.

Powder-CARTS, are for carrying powder with the army: they are divided into 4 parts, by boards of an inch thick, which enter about an inch into the shafts. Each of these carts can only flow 4 barrels of powder. The roof is covered with an oil-cloth, to prevent dampness from

C A R

from coming to the powder, and their dimensions are as follow :

	inch.
Wheels diameter - -	65
Sides and shafts total length -	180
From the hind { end to the cross-bar	5.5
{ cross-bar, to the fore	88.5
{ cross-bar	
From the fore cross-bar to the fore end	77.5
Breadth - { behind - -	3.3
{ fore cross-bar - -	4.4
{ middle - -	3.7
{ before - -	2.8
{ behind - -	3
Height - { fore cross-bar - -	4
{ before - -	2.8
Opening behind, and at fore cross-bar	34
Two-shaft cross-bars { length - -	34
{ breadth - -	2
{ height - -	3
Under cross-bars { length - -	40
{ breadth - -	3
{ height - -	2
Side-pieces - { length - -	100
{ breadth - -	13
{ height - -	3
Axle-tree passes through the side-pieces from the bottom	3
From the shaft to the beginning of the roof	6
Height of the roof - -	12
Sides - { length - -	88
{ breadth - -	10
{ thickness - -	1
Roof-sides - { length - -	88
{ breadth - -	11
{ thickness - -	1
Opening at the middle of the cross-bar	35
Opening before, and at the hind cross-bar.	25

The *iron-work* is as follows :

Side-bolts with screws - -	8
Cross-bolts with single keys - -	2
Double hinges for the short lids - -	6
Staples with keys and chains - -	4
Hinges for roof lids - -	2
Nails, staples, and keys for ditto - -	3
Axle-tree pins with keys - -	2

Complete iron for shafts, wheels, and axle-trees. See *UMEREL* and *Travelling-CARRIAGE*.

Sling-CARTS, are used to carry mortars or heavy guns from one place to another, at a small distance, but chiefly to transport guns from the water-side to the proof-place, and from thence back again; as also to convey artillery to the batteries in a fortification, &c. Their dimensions are as follow :

C A R

	inch.
Wheels height - -	60
Naves length - -	15.5
Diameter { body - -	14
{ middle - -	16
{ lynch - -	12
Fellies - { breadth - -	3.4
{ height - -	5.5
Spokes - { breadth - -	2
{ thickness - -	3
Axle-tree length - -	77.5
Body - { length - -	40.5
{ breadth - -	5
{ height - -	5.5
Arms length - -	18.5
Diameter { body - -	5
{ lynch - -	4
Shafts total length - -	168
From the centre of the axle-tree to the fore end	144
Breadth { from the hind end to the cross-bar	7
{ middle - -	5.5
{ fore end - -	3.4
Opening { axle-tree & fore cross-bar	23
{ middle - -	30
{ before - -	24
Height of the shafts - -	3.6
Cross-bars - { breadth - -	4
{ thickness - -	2
{ length below - -	28
{ above - -	7
Cheeks to support the roller { height - -	9
{ thickness - -	4
{ interval - -	32
Diameter of the roller - -	7
From the centre of the axle-tree to the fore end	24

Iron-work of a Sling-CART, is as follows :

Cross-bars - -	2
Round-headed nails to fasten the cross-bars	4
Bolts with screws to fasten the cheeks	7

Wheels and shafts complete.

CARTEL, in *military transactions*, an agreement between two states at war for the exchange of their prisoners of war.

CARTE-BLANCHE, in *military affairs*, signifies an unlimited power to act to the best of one's judgement. It likewise strictly means a blank paper; a paper to be filled up with such conditions as the person to whom it is sent thinks proper.

CARTOUCH, in *military affairs*, is a case of wood about 3 inches thick at bottom, bound about with marline, holding about 400 musket-balls, besides 8 or 10 iron balls of a pound each,

each, to be fired out of a howitzer, for the defence of a pass, &c. See GRAPE-SHOT.

CARTRIDGE, a case of paper, parchment, or flannel, fitted to the bore of the piece, and holding exactly its proper charge. Musket and pistol cartridges are always made of strong paper, between 30 and 40 of which are made from 1 pound of powder, including their priming. Cannon and howitzer cartridges are sometimes made of parchment, though more generally of flannel: the charges they contain are adapted to the service they are intended for.

CARTRIDGE-BOX, a case of wood, made in a circular form, to wear before the body of the soldier, holding 24 musket-ball cartridges in two rows: it is covered with leather, and worn upon a belt, both on duty, and on the day of battle. See FORTEN.

CASCADE, in *artillery*, is the very hinder most knob or button of the cannon, or the most part of the breech. See CANNON.

CASCADS, in *fortification*, holes in the form of wells, serving as entrances to galleries, or giving vent to the enemy's mines. See FORTIFICATION.

CASHEMERE, in *fortification*, a vault, or arch of mason work, in that part of the flank of a bastion which is next the curtain, made to defend the ditch, and the face of the opposite bastion. See FORTIFICATION.

CASERNES, in *fortification*, are buildings for the soldiers of the garrison to live in; generally erected between the houses of fortified towns, and the rampart.

CASE-SHOT. See SHOT, and LABORATORY.

CASSINE, in *military history*, signifies a small house in the country, generally surrounded with a ditch: they are very convenient to post small parties in, where they will be sheltered from any sudden attack, and can even make head till the nearest detachments can come and relieve them.

CASSIONS, chests filled with shells, and placed under ground, and fired: they are generally made to contain from 4 to 20 loaded shells, according to the execution they are to do. Their effects are more tremendous than mines.

CASTING, in *forming guns*, implies the operation of running any sort of metal into a mould prepared for that purpose.

CASTLE, in *military affairs*, a fortified place, or strong hold, to defend a town or city from an enemy. Castles are for the most part no higher in antiquity than the Conquest; or rather about the middle of king Stephen's reign. Castles were erected in almost all parts of the kingdom, by the several contending parties; and each owner of a castle was a kind of petty

prince, coining his own money, and exercising sovereign jurisdiction over his people. History informs us that 1017 castles were built in this reign.

CATAIROME. See CRANE.

CATAPALCO, in *military architecture*, a scaffold of timber, decorated with sculpture, painting, &c. for supporting the coffin of a deceased hero, during the funeral solemnity.

CATAPULTA, in *military architecture*, an engine contrived for the throwing of stones, darts and bones, upon the enemy. Some of these engines were so large, and of such force, that they would throw stones, of an hundred weight. Josephus takes notice of the surprising effects of these engines, and says, that the stones thrown out of them beat down the battlements, knocked off the angles of the towers, and had force sufficient to level a very deep file of soldiers.

CATTUS, in *ancient military history*, was

CATHOUSE, a kind of covered shed, sometimes fixed on wheels, and similar to the *Vima* and *Pluteus* of the ancients.

CAVALCADE, in *military history*, implies a pompous procession of horsemen, equipages, &c. by way of parade, to grace a triumph, public entry, or the like.

CAVALIER, in *fortification*, is a work generally raised within the body of the place, 10 or 12 feet higher than the rest of the works. Their most common situation is within the bastion, and made much in the same form: sometimes they are placed in the gorges, or on the middle of the curtain; they are then made in the form of a horse-shoe. See FORTIFICATION. Their use is to command all the adjacent works and country round about it: they are seldom or never made but when there is a hill or rising ground, which overlooks some of the works.

Trench-CAVALIER, in the *attacks*, is an elevation which the besiegers make by means of earth or gabions, within half-way, or two thirds of the glacis, to discover, or to enfilade the covert way.

CAVALRY, in *military affairs*, that body of soldiers that serves and fights on horseback: under this denomination are included, viz.

Horse, that is, regiments or troops of horse. In England there are, the horse-guards, commonly called the *first and second troops of horse-guards*; the *first and second troops of grenadier-guards*; the *royal regiment of horse-guards*. And in Ireland there are four regiments of horse-guards. The first troop of horse was raised in 1660.

C A V

Dragoons, are likewise regiments of horse, but distinguished from the former by being obliged to fight both on foot and on horseback. In England there is the first, or king's regiment of dragoon-guards; the second, or queen's regiment of dragoon-guards; the third, or prince of Wales's regiment of dragoon-guards. Likewise, the first, or royal regiment of dragoons; the second, or royal North-British dragoons; the third, or king's own regiment of dragoons: besides, the royal Irish dragoons, Inniskilling regiment of dragoons, queen's regiment of dragoons, prince of Wales's regiment of dragoons, with 10 more regiments of dragoons. The first regiment of dragoons was raised in 1681.

Hunters. See **LIGHT-HORSE**.

Light-horse, are regiments of cavalry, mounted on light, swift horses, whose men are but small, and lightly accoutred. They were first raised in the last war, in 1757.

Hussars, generally Hungarian horse. Their uniform is a huge furred cap, adorned with a cock's feather; those of the officers, either with an eagle's or a heron's; a very short waistcoat, with a pair of breeches and stockings in one; short light boots, generally of red or yellow leather; with a curious doublet, having five rows of buttons, which hang loosely on the left shoulder. Their arms are a long crooked sabre, light carbines, and pistols. Before they begin an attack, they lay themselves so flat on the necks of their horses, that it is hardly possible to discover their force; but, being come within pistol-shot of the enemy, they raise themselves with such surprising quickness, and fall on with such vivacity, that it is very difficult for the troops to preserve their order. When a retreat is necessary, their horses have so much fire, and are so indefatigable, their equipage so light, and themselves such excellent horsemen, that no other cavalry can pretend to follow them: they leap over ditches, and swim over rivers, with a surprising facility. Most of the German powers have troops under this name, as also France.

CAVEATING, in *fencing*, implies a motion whereby a person in an instant brings his sword, which was presented to one side of his adversary, to the opposite side.

CAVIN, in *military affairs*, implies a natural hollow, sufficiently capacious to lodge a body of troops, and facilitate their approach to a place. If it be within musket-shot, it is a place of arms ready made, and serves for opening the trenches, free from the enemy's shot.

CAZEMATE. See **CASEMATE**.

C E N

CAZEMATE, } in *fortification*, is a certain
CASEMATE, } retired place in the flank of a bastion, for the defence of the ditch, and the face of the opposite bastion; not used at present. It also implies a well, having several subterranean branches, which are extended when they suspect the enemy is forming a mine, 'till they hear the miners at work.

CAZERNS. See **BARRACKS**.

CENOTAPH, in *military history*, implies the empty tomb of a hero, or a monument erected to the honour of a person, without the body of the deceased being interred in or near it.

CENTRE, } in a *general sense*, signifies a
CENTER, } point equally distant from the extremities of a line, surface, or solid.

CENTRE of a bastion, is a point in the middle of the gorge of the bastion, from whence the capital line commences, and which is generally at the inner polygon of the figure.

CENTRE of a battalion, on parade, is the middle, where an interval is left for the colours; of an incampment, it is the main street; and on a march, is an interval for the baggage, &c.

CENTRE of gravity, in *military mechanics*, is that point about which the several parts of a body exactly balance each other in any situation.

CENTRE of a conic-section, is the point where all the diameters meet.

CENTRE of an ellipsis, is that point where the transverse and conjugate diameters intersect each other.

CENTRE of motion, is that point which remains at rest while all the other parts of the body move about it.

CENTRE of percussion, is that point in which the force of the stroke is the greatest possible. When the moving body revolves round a fixed point, the centre of percussion is the same with the centre of oscillation, and found by the same method: but when the body moves in a parallel direction, the centre of percussion is the same with the centre of gravity.

CENTINEL, } is a private soldier, from the
CENTRY, } guard, posted upon any spot of ground, to stand and watch carefully for the security of the said guard, or of any body of troops, or post, and to prevent any surprise from the enemy. All centinels are to be very vigilant on their posts; neither are they to sing, smoke, or suffer any noise to be made near them. They are not to sit down, lay their arms out of their hands, or sleep; but keep moving about their posts during the two hours they stand, if the weather will allow of it. No centry to move more than 50 paces to the right,

right, and as many to the left of his post, and let the weather be never so bad, he must not get under cover. No one to be allowed to go from his post without leave of his commanding officer; and, to prevent desertion or marauding, the centries and vedettes must be charged to let no soldier pass.

CENTINEL perdu, a soldier posted near an enemy in some very dangerous post, where he is in perpetual danger of being lost.

CENTRY-box, a sort of wooden box, or hut, to shelter the centinel from the injuries of the weather; but, in fortifications made of masonry, they are made of stone, in a circular form.

CENTURY, in a *military sense*, means a hundred soldiers, who were employed in working the battering-ram.

CESSATION, or *cessation of arms*, in a *military figurative sense*, means a truce, or the total abrogation of all military operations for a limited time.

CHACE of a gun, generally means the whole length of it. See **CANNON**.

CHAFFERY, that part of a foundery where the forges are placed for hammering iron into complete bars, and thereby bringing it to perfection.

• **CHASSEURS**. See **HUNTERS**.

CHAIN for engineers, is a sort of wire chain divided into links of an equal length, made use of for setting out works on the ground, because lines are apt to shrink and give way.

There are several sorts of chains made use of in mensuration; as Mr. Rathbone's, of two perches in length; others one perch long; some of 1000 feet in length: but that which is most in use amongst engineers is Mr. Gunter's, which is 4 poles long, and contains 100 links, each link being $7\frac{1}{16}$ inches in length.

CHAIN-shot. See **SHOT**.

CHALLENGE, a cartel, or invitation to a duel or other combat: it may with propriety be called a provocation, or summons to fight, when an affront in derogation of honour has been offered.

CHAMADE, in a *military sense*, means a signal made by the enemy, either by beat of drum, or sound of trumpet, when they have any matter to propose; such as to bury their dead, &c. See **PARLEY**.

CHAMBER of a cannon, in *artillery*, that part of the bore of a cannon which receives the powder with which it is charged. See **CANNON**.

CHAMBER of a mortar, the space where the powder lies, and generally of several forms and dimensions, such as the conic, spheric, cy-

lindric, parabolic, and concave or bottled chambers. See **MORTARS**.

CHAMBER of a mine, that place where the charge of powder is lodged, to blow up the works over it. See **MINE**.

CHAMBER of a battery, is a place sunk underground for holding powder, loaded flint and fuzes, where they may be out of danger, and also preserved from the rain.

CHANDELIERS, in *military affairs*, a kind of moveable parapet, consisting of wooden frames, on which fascines are laid to cover the workmen when at work on the trenches. They are made of various sorts and sizes, according to the use they are for.

CHAPE, the metalline part put on the end of a scabbard, to prevent the point of the sword from piercing through it.

CHARACTER, in a *general sense*, implies any mark used for representing either ideas or objects.

Military CHARACTERS, } are certain marks

Mathematical CHARACTERS, } invented for avoiding prolixity, and more clearly conveying the thoughts of the learned in those sciences to beginners; the chief of which are as follow:

+ in algebra is the sign of the real existence of the quality it stands before, and is called an affirmative, or positive sign. It is also the mark of addition, and signifies that the numbers or quantities on each side of it are added together; as, if you see $a+b$, or $3+5$, it implies that a is added to b , or 3 added to 5. It stands for the word *more* also. Thus $5+4+7$ is read 5 more 4, more 7, equal to 16. So also $a+b+c+d$, shews that a , b , c , and d , are to be added together.

— This is the note of negation, negative existence, or non-entity. It is the sign of subtraction, and signifies that the numbers or quantities which come after it, are to be taken from the numbers or quantities which stand before it. Thus $a+b-c$, shews, that the quantity c is to be taken from the sum of a and b . It stands for the word *less* also. Thus $9-5$, is read 9 less 5, which is 4; and $b-9$, is b less 9, and shews that 9 is to be taken from the quantity b , &c.

N. B. That + signifies a *positive* or *affirmative* quantity, or *absolute* number; but — signifies a *fictitious* or *negative* number or quantity. Thus — 8, is 8 times less than nothing. So that any number or quantity with the sign + being added to the same number or quantity with the sign —, their sum will be equal to nothing. Thus 8 added to — 8 is equal to 0, but — 8 taken from + 8, is equal to 16.

\times is the sign of multiplication. It signifies *into*, or *multiplied by*; thus $4 \times 5 \times 3$, shews, that 4 is to be multiplied by, or into 5, and their product, by or into 3. So also $a \times b \times c \times d$, shews the continual multiplication of a , b , c , and d .

N. B. When quantities are placed one after another, without any sign or character, it shews their multiplication. Thus ab is $a \times b$, &c.

\div is the mark of division, and signifies that the numbers or quantities before it are to be divided by the numbers after it. Thus $a \div b$, means that a is to be divided by b ; so $16 \div 4$, shews that 16 must be divided by 4. There is a better way of expressing division, and which is more frequently used; and this is by placing the dividend at top, and the divisor underneath it. Thus a divided by b , is placed $\frac{a}{b}$; also 16 divided by 4, thus $\frac{16}{4}$, &c.

$=$ are the signs of equality, and signify that the quantities and numbers on the one side of it are equal to the quantities and numbers on the other; as $a = b$, or $AB = CD$; that is, a is equal to b , and AB is equal to CD , &c.

$\sqrt{}$ is the sign of radicality, and shews (according to the index of the power that is set over or after it) the square, cube, or other root, is extracted, or is to be so, out of any quantity, as $\sqrt{16}$, or $\sqrt[3]{16}$, or $\sqrt{(2)} 16$ is the square root of 16. This character sometimes affects several quantities, distinguished by a

line drawn over them thus, $\sqrt{b+d}$ denotes the square root of the sum of b and d . When any term or terms of any equation are wanting, they are generally supplied by one or more asterisks: thus in the equation.
$$x^2 + py + \frac{1}{4}p^2 + q \Big\} = 0, \text{ the term } py \text{ vanishing,}$$
$$-py - \frac{1}{4}p^2 \Big\}$$
 is marked with an asterisk, as $y^2 * - \frac{1}{4}p^2 + q$.

$\sqrt[3]{}$ is the sign of the cube root, and signifies the extraction of it, as in the square root above.

\div is the sign of continued or geometrical proportion: thus, $a \div b \div c$, &c. are quantities in geometrical proportion: but geometrical proportion is better expressed by one and the same quantity, with the sign after them. Thus $a, aa, aaa, aaaa$, or a^2, a^3, a^4, a^5 , &c. are quantities in geometrical proportion. So also 2, 4, 8, 16, 32, 64 \div , &c. and in continual proportion.

$::$ is the mark of geometrical proportion disjunct, and is usually placed between two pair of equal ratio's; as $3 : 6 :: 4 : 8$, shews

that 3 is to 6, as 4 to 8. Or $a : b :: d : e$, and are thus read, as a is to b , so is d to e , &c.

$>$ or \sqsupset are signs of majority; thus, $a > b$ expresses that a is greater than b .

$<$ or \sqsubset are signs of minority; and when we would denote that a is less than b , we write $a < b$, or $a \sqsubset b$, &c.

$\sqrt[3]{a \times b + c}$ signifies, that the product of a and b added to c is to have its cube root extracted. The same of the square root.

$\sqrt{a \times b + c - d}$ shews, that after the quantity d is taken out of the product of a and b more the sum of c , the remainder is to have its square root extracted.

$\overline{}$ is often used to couple or link quantities together, for the better reading or understanding them. Besides, they are differently expressed from what they are when it is wanting. Thus, $a \times b + c + d$ has quite a different signification from what it has with the dash over it; thus, $a \times \overline{b + c + d}$; for $a \times \overline{b + c + d}$, signifies, that the quantity a is to be multiplied by the sum of b , c , and d ; whereas, without the dash, it would signify only that the sum of the quantities c and d is to be added to the product of a into b .

$\sqrt{m + \frac{b}{4} + dd - c}$ signifies, that the quantity c is to be taken out of the square root of $m + \frac{b}{4} + dd$. But

$\sqrt{m + \frac{b}{4} + dd - c}$ signifies, that only the square root of $m + \frac{b}{4}$ is to be extracted, and then the difference between the quantities $dd - c$ to be added to it. The same for the cube root.

\pm signifies *more or less such a quantity*, and is used often in extraction of roots, completing of squares, &c.

Artillery-CHARACTERS, most generally used, are as follow:

C. qr. lb. which signifies centners or hundreds of 112 pounds, *qr.* quarters of 28 pounds, *lb.* pounds. Thus a piece of artillery with $4 : 3 : 16$, is 14 hundred, 3 quarters, and 16 pounds.

Pr. signifies pounder. Thus 24 *pr.* is a 24-pounder.

T. C. qr. lb. signifies tons, centners, quarters, pounds; and 28 *lb.* is one quarter, 4 *qr.* is one centner, or 112 pounds, and 20 *C.* is one tun.

CH A

lb. oz. dr. means, pounds, ounces, and drams: 16 *dr.* is one ounce, and 16 *oz.* is one pound.

lb. oz. dwt. gr. is pounds, ounces, penny-weights, and grains; of which 24 *gr.* make one pennyweight, 20 *dwt.* make one ounce, and 12 *oz.* one pound of troy-weight.

CHARACTERS in fire-works are these following.

M Means meal-powder.

⊖ Corned powder.

⊖ Saltpetre.

Z Brimstone.

CZ Crude fulphur.

C + Charcoal.

CS Sea-coal.

BR Beech raspings.

Sx Steel or iron filings.

Bx Brafs-duft.

Gx Glafs-duft.

Tx Tanners duft.

CI Cast-iron.

CA Crude antimony.

× Camphor.

AY Yellow amber.

LS Lapis calaminaris.

⊖ Gun.

BL Lamp-black.

GI Iling-glafs.

W Spirit of wine.

ST Spirit of turpentine.

PO Oil of spike.

CHARACTERS used in the arithmetic of infinities are dots over letters, denoting the character of an infinitesimal, or fluxion. Thus the first fluxions of *x*, *y*, *z*, being marked thus, \dot{x} , \dot{y} , \dot{z} ; the second are \ddot{x} , \ddot{y} , \ddot{z} ; and the third $\ddot{\ddot{x}}$, $\ddot{\ddot{y}}$, $\ddot{\ddot{z}}$.

Geographical CHARACTERS, are °, ', ", &c. which signify degrees, minutes, seconds, thirds. Thus 40°, 35', 18", 55"', is read 40 degrees, 35 minutes, 18 seconds, 55 thirds. It is also used in the elevation of pieces of artillery.

CHARGE, in gunnery, implies the quantity of powder, shot, ball, shells, granadoes, &c. with which a gun, mortar, or howitzer, is loaded.

As pieces of artillery are of various denominations, and consequently made use of on several occasions, their charges thence must have many variations. I shall therefore endeavour to explain every kind of charge in the following tables, deducted from practice.

CH A

CHARGES for heavy guns from a 42-pounder to a 3-pounder, both brafs and iron, in proof, service, saluting, and ricochet.

Caliber	Proof		Service		Saluting	Ricochet
	Brafs	Iron	Brafs	Iron		
prs.	lb. oz.	lb. oz.	b. oz.	b. oz.	b. oz.	lb. oz.
42	31 8	25	14	12	10 4	3 4
32	26 12	21 8	10 10	9 4	8	2 14
24	21	18	8	8	6	2
18	18	15	6	8	4 8	1 12
12	12	12	4	4	3	1 6
9	9	9	3	3	2 8	1 4
6	6	6	2 8	2 8	2	1
3	3	3	1	1	12	1

CHARGES for medium guns.

	Proof		Service		Saluting	Ricochet
	Brafs	Iron	Brafs	Iron		
prs.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
24	18	18	8	8	4	1 12
12	9	9	3 8		2 8	1 4
6	6	6	2	2 4	1 4	12
3	3	3	1	1	14	8

CHARGES for light guns.

	Proof		Service		Saluting	Ricochet
	Brafs	Iron	Brafs	Iron		
prs.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
24	10	5	5		4	1 12
12	6		3		2 8	1 4
6	3		1 8		1 4	12
3	1 8	1 12	12		14	8

CHARGED cylinder, in gunnery, implies that part of the chase of a gun, which contains the powder and ball.

CHART, or sea-CHART, is a hydrographical map, or a projection of some part of the earth's superficies in plano, for the use of navigators and geographers.

Plane-CHART, is a representation of some part of the superficies of the terraqueous globe, in which the meridians are supposed parallel to each other, the parallels of latitude at equal distances, and consequently the degrees of latitude and longitude every where equal to each other.

CHART of reduction, is that where the meridians are represented by right lines, inclining towards each other: thence it appears by construction, that these charts must correct the errors of the plane ones. But since these parallels

parallels should cut the meridians at right angles, and do not, they are defective, inasmuch as they exhibit the parallels inclined to the meridians.

Mercators-CHART, is that where the meridians are strait lines parallel to each other, and equidistant: these parallels are also strait lines, and parallel to each other; but the distance between increases from the equinoctial towards each pole, in the ratio of the secant of the latitude to the radius.

Globular-CHART, a meridional projection, wherein the distance of the eye from the plane of the meridian, upon which the projection is made, is supposed to be equal to the sine of the angle of 45° . This projection comes the nearest of all to the nature of the globe, because the meridians therein are placed at equal distances.

Chorographic-CHARTS, are descriptions of particular countries.

Heliographic-CHARTS, descriptions of the body of the sun, and of the maculae or spots observed in it.

Selenographic-CHARTS, particular appearances of the spots of the moon, her appearance and maculae.

CHASE of a gun. See **CHACE**.

To **CHASE the enemy**, means to march after them on horseback in full speed. To pursue a ship at sea.

CHAUSSE, or *Res de CHAUSSE*, an old expression for the level of the field, or the plain ground.

CHAUSSE-traps. See **CRAWS-FEET**.

CHEEKS of a gun-carriage. See **CARRIAGE**.

CHEEKS of a mortar-bed. See **BED**.

CHEEKS of a waggon. See **WAGGON**.

CHEMIN-Couvert. See **COVERT-WAY**.

CHEMIN des rondes, in *fortification*, a space between the rampart and low parapet under it, for the rounds to go about it.

CHEMISE, in *fortification*, a word almost out of use, the wall with which a bastion, or any other work of earth, is lined for its greater support and strength: or it is the solidity of the wall from the talus to the stone-row.

CHEMISTRY, the art of examining bodies, and of extracting from them any of their component parts.

CHEVALIER, in a *general sense*, signifies a knight or horseman.

CHEVALER, in the manege, is said of a horse when, in passing upon a walk or trot, his off fore leg crosses the near fore leg every second motion.

CHEVAUX-de-frise, in *fortification*, a large joist or piece of timber, about 5 or 6 inches square, and 10 or 12 feet in length; into the sides whereof are driven a great number of wooden pins, about 6 feet long, and $1\frac{1}{2}$ inch diameter, crossing one another at right angles, and pointed with iron. They are used on numberless occasions, as to stop up the breaches, to secure the avenues of a camp from the inroads both of horse and foot. They are sometimes mounted on wheels, with artificial fires, to roll down in an assault, &c. They were first used at the siege of Groningen, in 1658.

CHEVRETTE, a kind of gin. Among the many inventions for raising guns or mortars into their carriages, this engine is very useful: it is made of two pieces of wood about 4 feet long, standing upright upon a third, which is square: they are about a foot asunder, and parallel; pierced with holes opposite one another, to hold a strong bolt of iron, which may be raised higher or lower at pleasure: it may be used with a hand-spike, which takes its poise over this bolt, to raise any thing by force.

CHOROGRAPHY, in *engineering*, is the art of making a drawing or map of a country, province, or district.

CIMETER, See **SIMITAR**.

CINQUAIN, in *ancient military history*, was an order of battle, to draw up 5 battalions, so that they may make 3 lines; that is, a van, main-body, and reserve. Supposing the 5 battalions to be in a line, the 2d and 4th advance and form the van, the 3d falls back and forms the rear, the 1st and 5th form the main body upon the same ground. Lastly, every battalion ought to have a squadron of horse on both the right and left wings. Any number of regiments, produced by multiplying by 5, may be drawn up in the same manner; as $10 \times 5 = 50$. $15 \times 5 = 75$. $20 \times 5 = 100$, &c.

CIRCUMVALLATION, or *line of circumvallation*, in *military affairs*, implies a fortification of earth, consisting of a parapet and trench, made round the town intended to be besieged, when any molestation is apprehended from parties of the enemy, which may march to relieve the place.

Before the attack of a place is begun, care is to be taken to have the most exact plan of it possible; and upon this, the line of circumvallation and the attack are projected. This line, being a fortification opposed to an enemy that may come from the open country to relieve the besieged, ought to have its defences directed against them; that is, so as to fire from
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the town : and the besiegers are to be encamped behind this line, and between it and the place. The camp ought to be as much as possible out of the reach of the shot of the place ; and the line of circumvallation, which is to be farther distant from the place than the camp, ought much more to be out of the reach of its artillery.

As cannon are never to be fired from the rear of the camp, this line should be upwards of 1200 fathoms from the place : we will suppose its distance fixed at 1400 fathoms from the covert way. The depth of the camp may be computed at about 30 fathom, and from the head of the camp to the line of circumvallation 120 fathoms, that the army may have room to draw up in order of battle at the head of the camp, behind the line. This distance, added to the 30 fathoms, makes 150 fathoms, which being added to the 1400, makes 1550 fathoms for the distance of the line of circumvallation from the covert-way. The top of this line is generally 12 feet broad, and 7 feet deep : the parapet runs quite round the top of it, and at certain distances is frequently strengthened with redouts and small forts ; the base 18 feet wide, the height within 6, and on the outside 5 feet, with a banquet of 3 feet wide, and $1\frac{1}{2}$ high. See CONTRAVALLATION, or COUNTERVALLATION.

CIRCUS, in *military antiquity*, a very capacious building, of a round or oval form, erected by the ancients for exhibiting shews to the people.

CITADEL, is a fort with 4, 5, or 6 bastions, raised on the most advantageous ground about a city, the better to command it, and commonly divided from it by an esplanade, the better to hinder the approach of an enemy ; so that the citadel defends the inhabitants if they continue in their duty, and punishes them if they revolt. Besiegers always attack the city first, that, being masters of it, they may cover themselves the better against the fire of the citadel. Its having bastions distinguishes it from a castle. Sometimes the citadel stands half within, and half without the ramparts of the place.

CIVIC-CROWN, among the ancient Romans, was a crown given to any soldier who had saved the life of a citizen. It was composed only of oaken-boughs, but accounted more honourable than any other.

CLARENCIEUX, the second king at arms, so called from the duke of Clarence, third son to King Edward III.

CLARIGATION, in *Roman antiquity*, a ceremony which always preceded a formal decla-

ration of war, performed in this manner : the chief of the heralds went to the territory of the enemy ; where, after some solemn prefatory indication, he, with a loud voice, intimated that he declared war against them for certain reasons specified, such as injury done to the Roman allies, or the like.

CLAYES. See HURDLES.

CLEAR. To clear the trenches. See TRENCHES.

CLOATHING. See REGIMENTALS.

CLOY, or *to cloy guns*. See *To NAIL*.

CLOUTS. See AXLE-TREE.

CLY-MORF, a great two-handed sword, formerly in use among the highlanders, two inches broad, doubly edged ; the length of the blade, 3 feet 7 inches ; the handle, 14 inches ; of a plain transverse guard, 1 foot ; the weight, 6 pounds and a half. These swords were the original weapons of England, as appears by the figure of a soldier found among the ruins of London, after the great fire in 1666.

COFFERS, in *fortification*, a hollow lodgment sunk in the bottom of a dry ditch, from 6 to 7 feet deep, and from 16 to 18 feet broad, and the length of it, the whole breadth of the said ditch, from side to side. The besieged generally make use of these coffers to repulse the besiegers, when they attempt to pass the ditch : they are distinguished only by their length from *Caponiers* ; and it differs from the traverse and gallery, in that these are made by the besiegers, and the coffer by the besieged. They are covered with joists, hurdles, and earth, raised 2 feet above the bottom of the ditch ; which rising serves instead of a parapet, with loop-holes in it.

COFFRE. See CAISSON.

COHORT, in *Roman antiquity*, a name given to part of the Roman legion, comprehending about 600 men.

COINS, in *gunnery*, are a kind of wedges to lay under the breech of a gun, to raise or depress the metal.

COLONEL, in *military affairs*, the commander in chief of a regiment, whether horse, foot, dragoons, or artillery, in England : but in France, Spain, and some other southern nations, the colonels of horse are called *Maîtres de Camp* ; in Germany, and most northern nations, they are called *Rittmeesters*. Colonels of foot take place, and command one another, according to the seniority of their regiments, and not of their commissions ; but those of horse, on the contrary, according to the dates of their commissions.

COLONEL of horse, who is the first officer of the

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the regiment; hence his attention ought to be given to keeping the regiment complete, to have it composed of both men and horses fit for the service, and to take particular care to have them well exercised and taught the different evolutions; to be able on all occasions to form themselves according to the ground, or manner in which they may attack or be attacked.

COLONEL of foot, or infantry. His functions are more extensive than those of the cavalry, as the infantry are employed to more different purposes. They should understand something of fortification, and be well acquainted with field-engineering. He cannot be too careful to maintain union and harmony among his officers; and, to succeed in this, he must acquire their esteem and confidence, and make himself to be respected. The true way to succeed in this, is to keep up subordination with unalterable firmness; to do justice to every one, to employ all his credit to procure favours to the corps in general, and to the officers in particular.

COLONEL of dragoons is nearly connected with that of horse, to which word I refer the reader.

COLONEL of artillery. The commander of a battalion of artillery is one of the most laborious employments both in war and peace, requiring the greatest ability, application, and experience. He is supposed to be a very able mathematician and engineer, to be thoroughly acquainted with the power of artillery, to understand the attack and defence of fortifications in all the different branches; to be able on all occasions to form the artillery according to the ground or manner in which they may attack or be attacked; in short, he should be master of every thing belonging to that important corps.

COLONEL of engineers, should be a very able mathematician and mechanic, master of fortification, in planning, constructing, attacking, and defending the same. See **ENGINEER**.

Lieutenant COLONEL, is the second person in command of a regiment, and it is under his direction that the affairs of the regiment chiefly roll. He is to have great qualifications, answerable to the corps he has the honour to serve in.

COLOURS, in the *military art*, are large silk flags fixed on half pikes, and carried by the ensign: when a battalion is encamped, they are placed in its front; but in garrison they are lodged with the commanding officer.

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The first standard, guidon, or colours of a regiment, is not to be carried on any guard but that of his Majesty, the Queen, Prince of Wales, or captain-general.

The size of the colours to be 6 feet 6 inches flying, and 6 feet deep on the pike. The length of the pike (spear and ferril included) to be 9 feet 10 inches. The cords and tassels of the whole to be crimson and gold mixed.

Camp-COLOURS, are a small sort placed on the right and left of the parade of a regiment when in the field: they are 18 inches square, and of the colour of the facing of the regiment, with the number of the regiment upon them. The poles to be 7 feet 6 inches long, except those of the quarter and rear-guards, which are to be 9 feet.

COLOUR-guard. See **GUARD**.

COLUMN, in the *art of war*, a long, deep file of troops or baggage. The advantages and disadvantages of columns are so numerous, that I will only mention, that the column ought to be able to form near the enemy, and in such a position, as not to suffer much from the artillery; that their motions be swift, so as not to suffer much during the operation; and that the divisions, in short, which compose it, be so arranged as to afford each other a mutual defence and assistance, in case they should be attacked. Such are the principles that should guide, in forming of columns judiciously, and of freeing them from that multiplicity of inconveniences which make them liable to the most melancholy accidents.

COMMAND, in *military affairs*, generally called *the word of command*, are terms used by officers in exercise, or upon service.

COMMANDANT, is that person who has the command of a garrison, fort, castle, regiment, company, &c.

COMMANDING-ground, implies, in a *military sense*, a rising ground which overlooks every post, or strong place. There are, strictly speaking, three sorts of commanding grounds; namely,

Front COMMANDING-ground. Every height is called so, that lies opposite to the face of the post which plays upon its front.

Reverse COMMANDING-ground, an eminence which plays upon the rear of a post.

Enfilade COMMANDING-ground, or *Curtain COMMANDING-ground*, a high place, which, with its shot, scours all the length of a line, &c.

COMMANDERY, a certain benefice belonging to some military order.

COMMISSARY, in *military affair*, is of various

various denominations, though generally a civil officer appointed to inspect the musters, stores and provisions for the army. In war-time their number is unlimited, but generally very numerous.

COMMISSARY-general of the musters, or muster-master general. He takes account of the strength of every regiment as often as he pleases; reviews them, sees the horse be well mounted, and all the men well armed and clothed. He receives and inspects the muster-rolls, and knows exactly the strength of the army.

COMMISSARY-general of stores, a civil officer in the artillery, who has the charge of all the stores, for which he is accountable to the office of ordnance. He is allowed various other commissaries, clerks, and conductors, especially in war-time.

COMMISSARY of the train-horses, a civil officer likewise of the artillery, who has the inspection of all horses belonging to the train, the hospital, and the bakery; having under him a number of conductors, drivers, &c.

COMMISSARY-general of provisions, has the charge of furnishing the army in the field with all sorts of provisions, forage, &c. by contract: he must be very vigilant and industrious, that they may never suffer want. He has under him various commissaries, store-keepers, clerks, &c.

COMMISSION, in a *military sense*, is the authority by which every officer acts in his post. All commissions are signed by the king, or by his general, if he be impowered.

COMMISSION officers. See OFFICERS.

COMMITTEE, a select number of persons to whom the more particular consideration of some matter is referred, and who are to report their opinion to the court, &c. of which they are members.

COMMUNICATION. See *Line of Communication*.

COMPANY, in a *military sense*, means a small body of foot or artillery, the number of which is never fixed, but generally from 45 to 110, commanded by a captain, a lieutenant, and an ensign, and sometimes by a first and second lieutenant, as in the artillery. A company has usually 2 serjeants, 3 or 4 corporals, and 2 drums. In the guards the companies consist of 80 men each.

Free COMPANY, is one of those corps commonly called irregular; is seldom or never under the same orders with the regular corps of the army, but for the most part acts like a detached army, either by itself, or in conjunction with some of its own kind; therefore their opera-

tions are properly considered under the title of the *petite guerre*.

Independent COMPANY, that which is not incorporated in a regiment. Two such companies generally belong to each regiment in England, who are to supply the regiments with recruits.

COMPLEMENT of the curtain, in *fortification*, is that part of the curtain which, being wanting, is the demi-gorge. See FORTIFICATION.

COMPLEMENT of the line of defence, the remainder of the line of defence, after you have taken away the angle of the flank. See FORTIFICATION.

COMPLEMENT of the line of the army. See HONOURS.

COMPLEMENT from guards. See HONOURS.

COMPOUND motion. See GUNNERY.

COMPTROLLER of the artillery, inspects the musters of the artillery, makes the pay-list, takes the account and remains of stores, and is accountable to the office of ordnance. This post is only in war-time.

CONGRESS, in *military and political affairs*, is an assembly of commissioners, deputies, envoys, &c. from several courts, meeting to agree on peace, or to concert matters for their common good.

CONDUCTORS, are assistants to the commissary of stores, to conduct depots, or magazines, from one place to another: they have also the care of the ammunition waggons in the field: they report to the commissary, and are under his command.

CONTACT, a touching, or the point or points where one body touches another.

CONTINGENT, something casual or uncertain, that may or may not happen.

CONTRAMURE, in *fortification*, is a wall built before another partition-wall to strengthen it, so that it may receive no damage from the adjacent buildings.

CONTRAVALLATION, in the *art military*, implies a line formed in the same manner as the line of circumvallation, to defend the besiegers against the enterprises of the garrison: so that the army, forming a siege, lies between the lines of circumvallation and contravallation. The trench of this line is towards the town, at the foot of the parapet, and is never made but when the garrison is numerous enough to harass and interrupt the besiegers by sallies. This line is constructed in the rear of the camp, and by the same rule as the line of circumvallation, with this difference, that as it is only intended to resist a body of troops much inferior to a force

force which might attack the circumvallation, so its parapet is not made so thick, nor the ditch so wide and deep; 6 feet is sufficient for the 1st, and the ditch 8 feet broad, and 5 feet deep.

Amongst the ancients this line was very common, but their garrisons were much stronger than ours; for, as the inhabitants of towns were then almost the only soldiers, there were commonly as many troops to defend a place, as there were inhabitants in it. The lines of circumvallation and contravallation are very ancient, examples of them being found in histories of the remotest antiquity. The author of the military history of *Louis le Grand* pretends, however, that *Cæsar* was the first inventor of them; but it appears from the chevalier de Follard's treatise on the method of attack and defence of places, used by the ancients, how little foundation there is for this opinion. This author asserts, with great probability on his side, that these lines are as ancient as the time in which towns were first surrounded with walls, or, in other words, fortified.

CONTRE *Queue d'ironde* } See *Swallow's Tail*.
Queue d'ironde

CONTRIBUTION, in *military history*, is an imposition or tax paid by countries who suffer the fury of war, to redeem themselves from being plundered and totally destroyed by the enemy; or when a belligerent prince wants money, raises it by contribution on the enemy's country, and is either paid in provision or in money, and sometimes in both.

CONVERSION, is a military motion or manœuvre, which turns the front of a battalion where the flank was, when the flank is attacked.

CONVOY, in *military affairs*, a detachment of troops employed to guard any supply of men, money, ammunition, provisions, stores, &c. conveyed in time of war, by land or sea, to a town, army, or the like. A body of men that marches to secure any thing from falling into the enemy's hand, is also called a *Convoy*. An officer, having the command of a convoy, must take all possible precautions for its security; and endeavour, before its march, to procure some good intelligence concerning the enemy's out-parties: and as the commanding-officer of the place from which the convoy is to march, and those of such other places as he is to pass by, are the most proper persons to apply to for assistance; he must therefore take such measures as will enable him to keep up a constant intercourse with them. The conducting a convoy is one of the most im-

portant and most difficult of all military operations.

COPPER-boats. See PONTONS.

CORBEILLES. See BASKETS.

CORDEAU, a line used by engineers, divided into fathoms, and feet, &c. to mark out works on the ground.

CORDON, in *fortification*, is a row of stones made round on the outside, and placed between the termination of the slope of the wall, and the parapet which stands perpendicular, in such a manner, that this difference may not be offensive to the eye; whence those cordons serve only as ornaments in walled fortifications.

CORDON, in *military history*, is an imaginary line of separation between two armies, either in the field or in winter-quarters.

CORIDOR. See COVERT-WAY.

CORNET, in the *military history of the ancients*, an instrument much in the nature of a trumpet: when the cornet only sounded, the ensigns were to march alone without the soldiers; whereas, when the trumpet only sounded, the soldiers were to move forward without the ensigns.

CORNET, in the *military history of the moderns*, the third commission officer in a troop of horse or dragoons, subordinate to the captain and lieutenant, equivalent to the ensign amongst the foot. His duty is to carry the standard, near the centre of the front rank of the squadron.

CORNISH-ring, in *gunnery*, the next ring from the muzzle backwards. See CANNON.

CORPORAL, an inferior or non-commission officer of foot, under a serjeant, who has charge of one of the squads of a company, places and relieves centinels, and keeps good order in the guard. He receives the word of the inferior rounds that pass by his guard. Every company has 3 or 4 corporals.

Lance-CORPORAL, one who acts as corporal.

CORPS de Garde. See GUARD.

CORPS de Bataille. The main body of an army drawn up for battle, whereof the first line is called the van, the second the main body, and the third the body of reserve, or rear-guard. See BATTLE.

CORPS de Reserve. See REAR-GUARD.

CORSAIR, in *naval history*, a name given to the piratical cruisers of Barbary, who frequently plunder the merchant-ships of countries with whom they are at peace.

CORSELET, a little cuirass; or, according to others, an armour, or coat made to cover the whole body anciently worn by the pikemen, usually placed in the fronts and flanks of the

the battle, for the better resisting the enemy's assaults, and guarding the soldiers placed behind them.

COSSACKS, in *military history*, a wild irregular people, who inhabit the Ukraine, and live by plunder and piracy, in small vessels on the Black Sea. A scythe fixed on the end of a pole was their ancient weapon. They are now a regular militia, and use the same arms as the Croats and Pandours.

COUNCIL of war, in *military affairs*, is an assembly of principal officers of an army or fleet, called by the general or admiral who commands, to concert measures for their conduct.

COUNTER-forts, in *fortification*, are certain pillars and parts of the wall, distant from 15 to 20 feet one from another, which advance themselves as much as may be in the ground, join themselves to the height of the cordon by vaults, to sustain the *chemin de rondes*, and the part of the rampart, to fortify the wall, and strengthen the ground.

COUNTERVALLATION, or *line of countervallation*, a trench with a parapet, made by the besiegers, betwixt them and the place besieged, to secure them from the sallies of the garrison; so that the troops which form the siege, are encamped between the lines of circumvallation and countervallation. When the enemy has no army in the field, these lines are useless.

COUNTERMARCH, in a *military sense*, is to march back again; a change of the wings and front of an army, battalion, or company, whereby the men in the front come to be in the rear.

COUP-d'*ail*, in *military history*, implies, in battle, to throw an attacking army into disorder, or, by its succession of resource, drive away an opposition not formed adequate to repulse its attackers. *Coup-d'*ail**, in *field fortification*, is, by irregular and detached works adapted to the ground, to form a complete systematical piece of fortification, though to a common eye disjointed and unconnected. So that this French word may not be improperly called a stratagem of war.

COURIER, in a *military sense*, means a messenger sent post, or express, to carry dispatches of battles gained, lost, &c. or any other occurrences that happen in war.

COURT-martial, a court appointed for the punishment of offences in officers, under-officers, soldiers, and sailors; the powers of which are regulated by the mutiny-bill, in the words, and to the effect following. His

majesty may, from time to time, grant a commission, under his royal sign manual, to any officer, not under the degree of a field-officer, for the holding a general court-martial within this realm; and also grant his warrant to the lord lieutenant of Ireland, or other chief governor or governors there for the time being, or the governor or governors of Minorca, Gibraltar, and any of his majesty's dominions beyond the seas respectively, or the person or persons there commanding in chief, from time to time, to appoint courts-martial in the kingdom of Ireland, and other places and dominions respectively; in which courts-martial, all offences mentioned in the articles of war, and all other offences hereinafter specified, shall be tried and proceeded against in such manner as the act for that purpose directs. The courts have power by their sentence of judgment to inflict corporal punishment, not extending to life or limb, on any soldier, for immoralities, misbehaviour, or neglect of duty. A general court-martial shall not consist of a less number than 13, whereof none to be under the degree of a commission officer; and the president of such general court-martial shall neither be the commander in chief, or governor of the garrison where the offender shall be tried, nor under the degree of a field-officer, unless where a field-officer cannot be had; in which case the officer next in seniority, not being under the degree of a captain, shall preside at such court-martial; and that such court-martial shall have power and authority to administer an oath to every witness, in order to the examination or trial of any of the offences that shall come before them.

That in all trials of offenders by general courts-martial, to be held by virtue of this act, every officer present at such trial, before any proceedings be had thereupon, shall take the following oaths upon the holy evangelists, before the court and judge advocate, or his deputy (who are hereby authorized to administer the same) in these words,

"You shall well and truly try and determine according to your evidence, in the matter now before you, between our sovereign lord the king's majesty, and the prisoner to be tried:

"So help you God."

The oath. "I A. B. do swear, that I will duly administer justice according to the rules and articles for the better government of his majesty's forces, and according to an act of parliament now in force for the punishment of mutiny and desertion, and other crimes therein mentioned, without partiality, favour, or affection; and if

any doubt shall arise, which is not explained by the said articles or act of parliament, according to my conscience, the best of my understanding, and the custom of war in the like cases. And I further swear, that I will not divulge the sentence of the court until it shall be approved by his majesty, the general, or commander in chief; neither will I upon any account, at any time whatsoever, disclose or discover the vote or opinion of any particular member of the court-martial, unless required to give evidence thereof, as a witness, by a court of justice in a due course of law.

"So help me God."

And as soon as the said oaths shall have been administered to the respective members, the president of the court is hereby authorized and required to administer to the judge advocate, or the person officiating as such, an oath in the following words:

The oath. "I A. B. do swear, that I will not, upon any account, at any time whatsoever, disclose or discover the vote or opinion of any particular member of the court-martial, unless required to give evidence thereof as a witness by a court of justice in a due course of law.

"So help me God."

And no sentence of death shall be given against any offender in such case by any general court-martial, unless 9 officers present shall concur therein; and if there be more officers present than 13, then the judgment shall pass by the concurrence of two-thirds of the officers present; and no proceeding or trial shall be had upon any offence, but between the hours of 8 o'clock in the morning and 3 in the afternoon, except in cases which require an immediate example.

Provided always, that the party tried by any general court-martial in the kingdom of Great-Britain or Ireland, or in Jersey, Guernsey, Alderney, or Sark, or the islands thereto belonging, shall be intitled to a copy of the sentence and proceedings of such court-martial, upon demand thereof made by himself, or by any other person or persons on his behalf (he or they paying reasonably for the same) at any time not sooner than 3 months after such sentence: and in case of trials by any general court-martial at Gibraltar or Minorca, at any time not sooner than 6 months after the sentence given by such court-martial; and in case of trials by any general court-martial in his majesty's other dominions beyond the seas, at any time not sooner than 12 months after the sentence given by such court-martial, whether

such sentences be approved or not; any thing in this act notwithstanding.

Provided also, and be it enacted by the authority aforesaid, that every judge advocate, or person officiating as such, at any general court-martial, do, and he is hereby required to transmit, with as much expedition, as the opportunity of time and distance of place can admit, the original proceedings and sentence of such court-martial to the judge advocate general in London; which said original proceedings and sentence shall be carefully kept and preserved in the office of such judge advocate general, to the end that the persons intitled thereto may be enabled, upon application to the said office, to obtain copies thereof, according to the true intent and meaning of this act.

Provided always, and be it hereby declared and enacted, that no officer or soldier, being acquitted or convicted of any offence, be liable to be tried a second time, by the same or any other court-martial, for the same offence, unless in case of an appeal from a regimental to a general court-martial; and that no sentence given by any court-martial, and signed by the president thereof, be liable to be revised more than once.

COUP-DE-MAIN, in *military affairs*, implies a desperate resolution in all small expeditions, of surprise, &c. The favourable side of the proposed action must ever be viewed; for if what may happen, arrive, or fall out, is chiefly thought upon, it will, at the very best, greatly discourage, but, in general, it will end in a total failure. The very name of an expedition implies risk, hazard, precarious warfare, and a critical but desperate operation, or *Coup-de-main*.

COVERT-WAY, in *fortification*, is a space of 5 or 6 fathoms on the border of the ditch towards the country, covered by a rising ground; which has a gentle slope towards the field. This slope is called the glacis of the covert-way. See **FORTIFICATION**.

Second COVERT-WAY, or, as the French call it *avant-chemin couvert*, is the covert-way at the foot of the glacis. See **FORTIFICATION**.

COVER, in a *military sense*, means that the files cover one another exactly. Troops are said to be covered when posted out of the danger of the enemy's fire.

COUNTER-approaches. See **APPROACHES**.

COUNTER-battery. See **BATTERY**.

COUNTER-breastwork. See **FALSE-BRAY**.

COUNTER-forts, in *fortification*, are certain pillars,

pillars, and parts of the wall of a fortification, at about 15 or 20 feet distance from each other, which are advanced as much as possible in the ground, and joined to the height of the cordons by vaults, to support the way of the rounds, and part of the ramparts; as also to fortify the wall, and strengthen the ground; generally used in large and strong fortifications.

COUNTER-guards, in *fortification*, are small ramparts, with parapets and ditches, to cover some part of the body of the place. They are of several shapes, and differently situated. They are generally made before the bastions, in order to cover the opposite flanks from being seen from the covert-way; consisting then of 2 faces, making a salient angle, and parallel to the faces of the bastion. They are sometimes made before the ravelins. See FORTIFICATION.

COUNTER-round. See ROUNDS.

COUNTER-mine. See MINES.

COUNTERSCARP, in *fortification*, is properly the exterior talus, or slope of the ditch, on the farther side from the place, and facing it. Sometimes the covert-way and glacis are meant by this expression. See FORTIFICATION.

COUNTER-swallow's-tail, in *fortification*, is a kind of an out-work very much resembling a single tenaille.

COUNTER-march. See MARCH.

To **COUNTERMAND**, is to give contrary orders to those already given, to contradict former orders, &c.

COUPURE, in *fortification*, are passages, sometimes cut through the glacis, of about 12 or 15 feet broad, in the re-entering angle of the covert-way, to facilitate the sallies of the besieged. They are sometimes made through the lower curtain, to let boats into a little haven built on the reentrant angle of the counterscarp of the out-works.

COURONEMENT, or *Couronnement*, in *fortification*, implies the most exterior part of a work when besieged.

CRAB. See GIN.

CRANE, an instrument made with ropes, pullies, and hooks, by which great weights are raised.

CREMAILLE, in *field fortification*, is when the inside line of the parapet is broken in such a manner as to resemble the teeth of a saw; whereby this advantage is gained, that a greater fire can be brought to bear upon the defile, than if only a simple face was opposed to it; and consequently the passage is rendered more difficult.

Redouts en CREMAILLE, or *Cremaille*, are such as are constructed as above mentioned.

CRETE, in *fortification*, implies the earth thrown out of the ditch in a fortification, trench, &c.

CROATS, in *military history*, light irregular troops so called; generally people of Croatia. They are commanded upon all desperate services, whose method of fighting is the same as the Pandours. They wear a short waistcoat, and long wide breeches, with light boots, and a cap greatly resembling the hussar cap. Their arms are a long firelock with rifled barrel, and short bayonet, a crooked hanger, and brace of pistols. The empress queen has 5000 of these troops, the greatest part of which have no pay, but live by plunder, at which they are remarkably dexterous.

CROWN-work, in *fortification*, an out-work that takes up more ground than any other. It consists of a large gorge, and two sides terminating towards the country in two demi-bastions, each of which is joined by a particular curtain, forming two half bastions and one whole one: they are made before the curtain, or the bastion, and generally serve to inclose some buildings which cannot be brought within the body of the place, or to cover the town gates, or else to occupy a spot of ground which might be advantageous to the enemy. See FORTIFICATION.

CROWNED horn-work, in *fortification*, is a horn-work, with a crown-work before it.

CROSS-fire, in *the art of war*, is when the fire of two or more adjoining sides of a field-redout, &c. crosses each other; frequently used in preventing an enemy's passing a defile. It may be two ways obtained: first, by constructing the redout with the face opposite to the defile, tenailed; that is, forming a re-entering angle. The other way is, to defend the defile by 2 redouts, whose faces command the passage, flanking each other at the same time.

CROSS-bars. See CARRIAGES.

CROWS-feet, in *the art of war*, are 4 pointed irons, so made, that what way soever they fall, one point is always uppermost. They are about 4 inches long, the short ones, and the long ones 6 or 7. The short ones are thrown on bridges, &c. and the long ones on the earth, both to incommode the cavalry, that they may not approach without great difficulty.

CROISADE } in *military history*, implies a
CRUSADE } holy war, or an expedition of the Christians against the Infidels for the recovery of the holy-land, and so called from those who engaged in it wearing a cross on their clothes.

CUBE,

C U B

CUBE, a solid, consisting of 6 equal square sides. The solidity of any cube is found by multiplying the superficial content of any one of the sides by the height. Cubes are to one another in the triplicate ratio of their diagonals.

CUBE-root, is the side of one of the squares constituting the cube. Thus, if the solidity of a cube be 64, the side of one of the squares, or cube-root, will be 4: because $4 \times 4 = 16$, the superficial content of the square, and $16 \times 4 = 64$, the solidity of the cube.

Cubic equation, in algebra, is an equation whose highest power consists of three dimensions, as $x = a^3 - 6^3$. See EQUATION.

Cubic foot, implies so much as is contained in a cube whose side is 1 foot, or 12 inches.

Cubic hyperbola, is a figure expressed by the equation $xy^2 = a$, having 2 asymptotes, and consisting of 2 hyperbolas, lying in the adjoining angles of the asymptotes, and not in the opposite angles, like the Apollonian hyperbola, being otherwise called, by Sir Isaac Newton, in his *enumeratio linearum tertii ordinis*, an hyperbolismus of a parabola; and is the 65th species of lines, according to him.

Cubic number, is that which is produced by multiplying any number by itself, and then again the product by that number; as 27 is a cube number, since $3 \times 3 = 9 \times 3 = 27$. The difference of two cubic numbers, whose roots differ by unity, is equal to the aggregate of the square of the root of the greater, double the square of the less, and the less root.

Cubic parabola, a curve of the second order, having infinite legs, tending contrary ways.

CUIRASSIERS, in the *military art*, are a sort of heavy cavalry armed with cuirasses, as most of the German horse are. The several German powers have regiments of cuirassiers, especially the emperor, and the king of Prussia. The king of France has also one regiment: but we have had none in the English army since the Revolution.

CUIRASSE, a piece of defensive armour, made of plate, well hammered, serving to cover the body, from the neck to the girdle, both before and behind, called breast and back-plate.

CULVERIN,

CULVERIN-ordinary,

CULVERIN of the largest size,

CUNEUS. See WEDGE.

CUNETTE. See CUVETTE.

CURFEW-bell, in *military history*, a signal given in cities taken in war, &c. to the inhabitants to go to bed. The most eminent

C Y L

curfew in England, was that established by William the Conqueror, who appointed, under severe penalties, that, at the ringing of a bell, at 8 o'clock in the evening, every one should put out their lights and fires, and go to bed, &c.

CURTAIN, in *fortification*, is that part of the body of the place, which joins the flank of one bastion to that of the next. See FORTIFICATION.

Angle of the CURTAIN,

Complement of the CURTAIN,

} See FORTIFICATION.

CUTLER, a *military artificer*, whose business is to forge, temper, and mount all sorts of sword-blades.

CYCLOPEDIA. See ENCYCLOPEDIA.

CYCLOID, in *geometry*, a curve generated in the following manner.

If a circle ABC (Pl. XII. fig. 6) resting on a right line AL , begin to revolve in the manner of a wheel, from A towards L , the point A will, by its two-fold motion, describe the curve $ACD \text{ } \text{ } \text{ } L$, while the circle makes one revolution from A to L .

This curve is called the cycloid; and from its formation it is evident, (1.) That the base of the cycloid AL is equal to the periphery of the generating circle ABC . (2.) That the axis of the cycloid FD is equal to the diameter of the said circle. (3.) That the part of the base KL is equal to the arch of the circle IK ; (4.) therefore KI ($= ME = IG$) is equal to the remaining arch IHI , or GD . (5.) That the chord of the circle KI is perpendicular to the cycloid in the point I ; and (6.) therefore the chord HI (being at right-angles with IK) is a tangent to the curve in the point I . (7.) The said tangent HI is parallel to the chord DG .

Parallel to EI draw ei indefinitely near; and In perpendicular thereto; then will the triangles DGE , DGF , Ini , be similar; and so we have $DE : DG :: DG : DF :: In : Ii$; consequently, the semi-cycloid $DIL = 2 DF$, the diameter of the generating circle. Pl. XII. fig. 6.

CUVETTE, in *fortification*, is a small ditch of 10 or 12 feet broad, made in the middle of a large dry ditch, about 4 or $4\frac{1}{2}$ feet deep, serving as a retrenchment to defend the ditch, or else to let water in, if it can be had in the time of a siege. See FORTIFICATION.

CYLINDER, or *concave cylinder of a gun*, is all the hollow length of the piece, or bore. See CANNON.

Charged

C Y L

Charged CYLINDER, the chamber, or that part which receives the powder and ball. See CANNON.

Vacant CYLINDER, that part of the hollow or bore which remains empty when the piece is loaded.

CYMBAL, in *ancient military history*, a war-like musical instrument in use among the ancients, made of brass, not unlike our kettle-drums, and, as some think, in their form, but smaller.

C Z A

CZAR, in *military history*, a title of honour assumed by the great dukes, or, as they are now stiled, emperors of Russia. This title is no doubt, by corruption, taken from *Cæsar*, emperor; and accordingly they bear an eagle, as the symbol of their empire. The first that bore this title was Basil, the son of Basilides, about the year 1470.

D

D A G

DAGGER, in *military affairs*, a short sword, or poignard, about 12 or 13 inches long, with a basket-hilt. It is not long since, that duellists fought with sword and dagger.

DAM. See DYKE.

DART, in *ancient military history*, implies a small kind of lance, thrown by the hand.

DAUPHIN, a title given to the eldest son of France, and heir presumptive to the crown, on account of the province of Dauphiny, which, in 1343, was given to Philip of Velois, on this condition, by Humbert, dauphin of the Viennois.

DEBENTURE, is a kind of warrant, given in the office of the board of ordnance, whereby the person whose name is therein specified, is intitled to receive such a sum of money as by former contract had been agreed on, whether wages, or otherwise. Debenture, in some of the acts of parliament, denotes a kind of bond or bill, first given in 1649, whereby the government is charged to pay the soldier, creditor, or his assigns, the money due on auditing the account of his arrears.

DECAGON, in *fortification*, is a polygon figure, having 10 sides, and as many angles; and if all the sides are equal, and all the angles, it is called a regular decagon, and may be inscribed in a circle. The sides of a regular decagon are, in power and length, equal to the greatest segment of an hexagon inscribed in the same circle, and cut in extreme and mean proportion. If AB (Plate xii. *fig. 7.*) be the side of a regular decagon inscribed in a circle, and it be continued out to C , so that $BC=AD$, then will $AB:BC::BC:AC$. Thence let r be the radius of the circle, and put $AB=x$, then became $AB \times AC = BC^2$, we have $x \times r \times x = rr$;

hence by completing the square, &c. we get $x = \sqrt{\frac{r^2}{2} - \frac{r^2}{4}} = r$, the side of the decagon inscribed in that circle.

DECAMPING, or *to decamp*, in *military affairs*, is the marching of an army or body of men from the ground where it before lay encamped. See CAMP.

DECANUS, in *Roman military history*, an officer who presided over ten other officers, and was head of the contubernium, or serjeants of a file of Roman soldiers.

DECIMATION, in *Roman military history*, a punishment inflicted upon such soldiers as quitted their post, or behaved themselves cowardly in the field. The names of all the guilty were put into an urn or helmet, and as many were drawn out as made the tenth part of the whole number; and these were put to the sword, and the others saved.

DECURIO, in *Roman military history*, a commander of ten men in the army, or chief of a decury.

DECURY, ten Roman soldiers ranged under one chief, or leader, called the Decurio.

DEFENCE, in *fortification*, are all sorts of works that cover and defend the opposite posts; as flanks, parapets, cazemettes, and fausse-brays. It is almost impossible to fix the mine to the face of a bastion, till the defences of the opposite one are ruined, that is, till the parapet of its flank is beaten down, and the cannon, in all parts that can fire upon that face which is attacked, are dismounted. See FORTIFICATION.

Line of DEFENCE, represents the flight of a musket-ball from the place where the musketeers stand, to scour the face of the bastion, and should never exceed the reach of a musket. It is either *fichant* or *razant*: the first is when

DEF

it is drawn from the angle of the curtain to the flanked angle; the last, when it is drawn from a point in the curtain, razing the face of the bastion.

Line of DEFENCE is the distance between the salient angle of the bastion, and the opposite flank; that is, it is the face produced to the flank. See FORTIFICATION.

DEFENCE of rivers, in military affairs, is a vigorous effort to prevent the enemy from passing; to prevent which, a careful and attentive officer will raise redouts, and if necessary join curtains thereto: he will place them as near the banks as possible, observing to cut a trench through the ground at the windings of the river, which may be favourable to the enemy, and place advanced redouts there, to prevent his having any ground fit to form on, &c. See RIVERS.

To be in a posture of DEFENCE, is to be provided to oppose an enemy, whether in regard to redouts, batteries, or in the open field.

DEFENSIVE-War. See WAR.

DEFILE, in *military affairs*, a strait narrow passage, or road, through which the troops cannot march, otherwise than in making a small front, and filing off; so that the enemy may take an opportunity to stop or harass their march, and to charge them with so much the more advantage, because the rear cannot come up to the relief of the front.

To DEFILE, is to reduce divisions or platoons into a small front, in order to march through a defile; which is most conveniently done by facing to either the right or left, and then wheeling to either right or left, and marching through by files, &c.

DEFILING a lodgement. See ENFILADE.

DEGRADATION, in a *military life*, the act of depriving an officer for ever of his commission, rank, dignity, or degree of honour; and taking away, at the same time, title, badge, and every other privilege of an officer.

DEGREE. Though this term properly belongs to geometry, nevertheless it is very frequently used both in fortification, and gunnery. Hence it will not be improper to declare, that it is a division of a circle, including a 360th part of its circumference. Every circle is supposed to be divided into 360°, parts called degrees, and each degree into 60', other parts, called minutes; each of these minutes being divided into 60", each second into thirds, and so on.

DEHORS, in the *military art*, are all sorts of out-works in general; placed at some distance from the walls of a fortification, the better to

DES

secure the main places, and to protect the siege, &c. See FORTIFICATION.

DELINEATION. See DESIGNING.

DEMI-BASTION, is a work with only one face and one flank. See FORTIFICATION.

DEMI	{	CANNON, <i>lowest</i> ,	}	See CANNON.
		CANNON, <i>ordinary</i> ,		
		CULVERIN,		
	{	CULVERIN of the { <i>largest fort</i> ,	}	
		{ <i>least size</i> ,		
		{ <i>eldest fort</i> .		

DEMI-LINE, in *fortification*, is a work placed before the curtain to cover it, and prevent the flanks from being discovered sideways: it is made of two faces, meeting in an outward angle. See FORTIFICATION.

DEMI-GORGE, in *fortification*, is half the gorge, or entrance into the bastion, not taken directly from angle to angle, where the bastion joins to the curtain, but from the angle of the flank to the centre of the bastion; or the angle the two curtains would make, by their prolongation. See FORTIFICATION.

DENSITY of bodies. See MOTION.

DEPOT, in the *military phrase*, signifies a particular place at the tail of the trenches, out of the reach of the cannon of the place, where the troops generally assemble, who are ordered either to attack the out-works, or support the troops in the trenches, when there is reason to imagine the besieged intend making a vigorous sally.

DEPOT, likewise means a temporary magazine for forage, for fascines, gabions, tools, and every other thing necessary for the support of an army, or for carrying on a siege.

DEPTH of a battalion or squadron, in military affairs, the number of ranks, or the quantity of men. Infantry were formerly drawn up 6 or 8 deep, that is, consisting of so many ranks; but now they are generally drawn up only 3 deep, and in the defence of a breast-work but 2 deep. When infantry is drawn up 3 deep, the first rank is called the front-rank; the second, the centre rank; and the third, the rear rank: and the files which bind the right and left, are called the flanks. The cavalry is generally drawn up 3 deep, and on some occasions only 2 deep.

DESCENT. See MOTION.

DESCENTS, in *fortification*, are the holes, vaults, and hollow places, made by undermining the ground.

DESCENT into the ditch, is a passage made through the esplanade and covert-way, in form of

of a trench, the upper part of which is covered with madriers, and clays or hurdles, to secure the besiegers from the enemy's fire. In wet ditches this trench is on a level with the surface of the water, but in dry ones it is sunk as deep as the bottom of the ditch.

DESERTER, in a *military sense*, a soldier who, by running away from his regiment and company, abandons the service.

Penalty of DESERTION. All officers and soldiers, who having received pay, or having been duly enlisted in our service, shall be convicted of having deserted the same, shall suffer death, or such other punishment as by a court-martial shall be inflicted.

Any non-commissioned officer or soldier, who shall, without leave from his commanding-officer, absent himself from his troop or company, or from any detachment with which he shall be commanded, shall, upon being convicted thereof, be punished according to the nature of the offence, at the discretion of a court-martial.

No non-commissioned officer or soldier shall enlist himself in any other regiment, troop, or company, without a regular discharge from the regiment, troop, or company, in which he last served, on the penalty of being reputed a deserter, and suffering accordingly: and in case any officer shall knowingly receive and entertain such non-commissioned officer or soldier, or shall not, after his being discovered to be a deserter, immediately confine him, and give notice thereof to the corps in which he last served, he the said officer so offending shall by a court-martial be cashiered.

Whatsoever officer or soldier shall be convicted of having advised any other officer or soldier to desert our service, shall suffer such punishment as shall be inflicted upon him by the sentence of a court-martial.

Justices may commit **DESERTERS.** And whereas several soldiers, being duly listed, do afterwards desert, and are often found wandering, or otherwise absenting themselves illegally from his majesty's service; it is hereby further enacted, that it shall and may be lawful to and for the constable, headborough, or tythingman of the town and place, where any person, who may be reasonably suspected to be such a deserter, shall be found, to apprehend, or cause him to be apprehended, and to cause such person to be brought before any justice of the peace, living in or near such town or place, who hath hereby power to examine such suspected person: and if by his confession, or the testi-

mony of one or more witnesses or witnesses upon oath, or by the knowledge of such justice of the peace, it shall appear, or be found, that such suspected person is a listed soldier, and should be with the troop or company to which he belongs; such justice of the peace shall forthwith cause him to be conveyed to the gaol of the country or place where he shall be found, or to the house of correction, or other public prison, in such town or place where such deserter shall be apprehended; or to the Savoy, in case such deserter shall be apprehended within the city of London or Westminster, or places adjacent; and transmit an account thereof to the secretary at war for the time being, to the end such person may be proceeded against according to law: and the keeper of such gaol, house of correction, or prison, shall receive the full subsistence of such deserter or deserters, during the time that he or they shall continue in his custody, for the maintenance of the said deserter or deserters; but shall not be intitled to any fee or reward, on account of the imprisonment of such deserter or deserters, any law, usage, or custom to the contrary notwithstanding.

Reward for taking up **DESERTERS.** And for the better encouragement of any person or persons to secure or apprehend such deserters as aforesaid; be it further enacted by the authority aforesaid, that such justice of the peace shall also issue his warrant in writing to the collector or collectors of the land-tax money of the parish or township where such deserter shall be apprehended, for paying, out of the land-tax money arising or to arise in the year 1778, into the hands of such person who shall apprehend, or cause to be apprehended, any deserter from his majesty's service, the sum of 20s. for every deserter that shall be so apprehended and committed; which sum of 20s. shall be satisfied by such collector, to whom such warrant shall be directed, and allowed upon his account.

Penalty for concealing **DESERTERS**, or *buying their arms, clothes, &c.* Provided always, that if any person shall harbour, conceal, or assist any deserter from his majesty's service, knowing him to be such, the person so offending shall forfeit, for every such offence, the sum of 5l. or if any person shall knowingly detain, buy, or exchange, or otherwise receive, any arms, clothes, caps, or other furniture belonging to the king, from any soldier or deserter, or any other person, upon any account or pretence whatsoever, or cause the colour of such

clothes to be changed; the person so offending, shall forfeit for every such offence the sum of 5*l*. and upon conviction by the oath of one or more credible witnesses or witnesses, before any of his majesty's justices of the peace, the said respective penalties of 5*l*. and 5*l*. shall be levied by warrant under the hands of the said justice or justices of the peace, by distress and sale of the goods and chattles of the offender; one moiety of the said first-mentioned penalty of 5*l*. to be paid to the informer, by whose means such deserter shall be apprehended; and one moiety of the said last-mentioned penalty of 5*l*. to be paid to the informer; and the residue of the said respective penalties to be paid to the officer to whom any such deserter or soldier did belong: and in case any such offender, who shall be convicted, as aforesaid, of harbouring or assisting any such deserter or deserters; or having knowingly received any arms, clothes, caps, or other furniture belonging to the king; or having caused the colour of such clothes to be changed, contrary to the intent of this act, shall not have sufficient goods and chattles, whereon distress may be made, to the value of the penalties recovered against him for such offence, or shall not pay such penalties within 4 days after such conviction; then, and in such case, such justice of the peace shall and may, by warrant under his hand and seal, either commit such offender to the common gaol, there to remain without bail or mainprize for the space of three months, or cause such offender to be publicly whipped, at the discretion of such justice.

DESIGN, in a *general sense*, implies the plan, order, representation, or construction of any kind of military building, chart, map, or drawing, &c. In building, the term *ichnography* may be used, when by design is only meant the plan of a building, or a flat figure drawn on paper: when some side or face of the building is raised from the ground, we may use the term *orthography*; and when both front and sides are seen in perspective, we may call it *scenography*.

DESIGNING, the art of delineating or drawing the appearance of natural objects, by lines on a plane.

DETACHED *pieces*, in *fortification*, are such out-works as are detached, or at a distance from the body of the place; such as half-moons, ravelines, bastions, &c.

DETACHMENT, in *military affairs*, an uncertain number of men drawn out from several regiments or companies equally, to march

or be employed as the general may think proper, whether on an attack, at a siege, or in parties to scour the country. A detachment of 2000 or 3000 men is a command for a general officer; 800 for a colonel, 500 for a lieutenant-colonel, 200 or 300 for a major, 80 or 100 for a captain, 40 for a lieutenant or ensign, 12 for a serjeant, and 6 for a corporal. Detachments are sometimes made of intire squadrons and battalions. One general rule, in all military projects that depend upon us alone, should be to omit nothing that can insure the success of our detachment and design; but, in that which depends upon the enemy, to trust something to hazard.

DETAIL of duty, in *military affairs*, is a roster or table for the regular and exact performance of duty, either in the field, garrison, or cantonments. The general detail of duty is the proper care of the majors of brigade, who are guided by the roster for the officers, and by the tables for the men, to be occasionally furnished.

DEVASTATION, in *military history*, the act of destroying, laying waste, demolishing or unpeopling towns, &c.

DIAMETER, in both a *military* and *geometrical sense*, implies a right line passing through the centre of a circle, and terminating at each side by the circumference thereof. See CIRCLE.

The impossibility of expressing the exact proportion of the diameter of a circle to its circumference, by any received way of notation, and the absolute necessity of having it as near the truth as possible, has put some of the most celebrated men in all ages upon endeavouring to approximate it. The first who attempted it with success, was the celebrated Van Culen, a Dutch-man, who, by the ancient method, though so very laborious, carried it to 36 decimal places: these he ordered to be engraven on his tomb-stone, thinking he had set bounds to improvements. However, the indefatigable Mr. Abraham Sharp carried it to 75 places in decimals; and since that, the learned Mr. John Machin has carried it to 100 places, which are as follow:

If the diameter of a circle be 1, the circumference will be 3.1415926535,8979323846,2643383279,5028841971,6939937510,5820974944,5923078164,0528620899,8628034825,3421170679, + of the same parts; which is a degree of exactness far surpassing all imagination.

But the ratios generally used in the practice of

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of military mathematics are these following. The diameter of the circle is to its circumference as 113 is to 355 nearly.—The square of the diameter is, to the area of the circle, as 452 to 355.—The cube of the diameter is, to the solid content of a sphere, as 678 to 355.—The cubes of the axes are, to the solid contents of equi-altitude cylinders, as 452 to 355.—The solid content of a sphere is, to the circumscribed cylinder, as 2 to 3—.

How to find the DIAMETER of shot or shells. For an iron ball, whose diameter is given, supposing a 9-pounder, which is nearly 4 inches, say, the cube root of 2.08 of 9 pounds is, to 4 inches, as the cube root of the given weight is to the diameter sought. Or, if 4 be divided by 2.08, the cube root of 9, the quotient 1.923 will be the diameter of a 1-pound shot; which being continually multiplied by the cube root of the given weight, gives the diameter required.

Or by logarithms much shorter, thus. If the logarithm of 1.923, which is .283979, be constantly added to the third part of the logarithm of the weight, the sum will be the logarithm of the diameter. Suppose a shot to weigh 24 pounds: add the given logarithm .283979 to the third part of .460070 of the logarithm 1.3802112 of 24, the sum .7440494 will be the logarithm of the diameter of a shot weighing 24 pounds, which is 5.5468 inches.

If the weight should be expressed by a fraction, the rule is still the same: for instance, the diameter of a $1\frac{1}{2}$ pound ball, or $\frac{3}{2}$, is found by adding the logarithm .2839793, found above, to .0586971 $\frac{1}{3}$ of the logarithm of $\frac{3}{2}$, the sum .3426764 will be the logarithm of the diameter required, i. e. 2.2013 inches.

As the diameter of the bore, or the caliber of the piece, is made $\frac{1}{10}$ part larger than that of the shot, according to the present practice, the following table is computed.

DIAMETERS of the shots and calibers of English guns.

lb.	0	1	2	3	4	5	6	7	8	9	
0	0	1.923	2.423	2.775	3.053	3.288	3.498	3.679	3.846	4.000	Diam.
	0	2.019	2.544	2.913	3.204	3.568	3.668	3.861	4.038	4.200	Calib.
1	4.143	4.277	4.403	4.522	4.635	4.743	4.846	4.945	5.040	5.131	Diam.
	4.349	4.490	4.623	4.748	4.866	4.981	5.088	5.192	5.292	5.368	Calib.
2	5.220	5.305	5.388	5.409	5.547	5.623	5.697	5.769	5.839	5.908	Diam.
	5.480	5.570	5.661	5.742	5.824	5.893	5.982	6.057	6.129	6.203	Calib.
3	5.975	6.041	6.105	6.168	6.230	6.290	6.350	6.408	6.465	6.521	Diam.
	6.273	6.343	6.410	6.475	6.541	6.604	6.666	6.707	6.788	6.846	Calib.
4	6.576	6.631	6.684	6.737	6.789	6.840	6.890	6.940	6.989	7.037	Diam.
	6.904	6.962	7.018	7.076	7.128	7.182	7.234	7.287	7.338	7.383	Calib.

EXPLANATION.

The numbers in the first horizontal line are units, and those in the first vertical column tens; the other numbers, under the one, and opposite to the others, are the respective diameters of shot and calibers. Thus, to

find the diameter of the shot, and the caliber of a 24-pounder, look for the number 2 on the left-hand side, and for 4 at top; then the number 5.547, under 4, and opposite 2, will be the diameter of the shot in inches and decimals, and the number 5.824, under the first, the caliber of a 24-pounder, &c.

DIAMETERS of leaden bullets from 1 to 29 in the pound.

	0	1	2	3	4	5	6	7	8	9
0	0	1.671	1.326	1.158	1.05	.977	.919	.873	.835	.803
1	.715	.751	.730	.711	.693	.677	.663	.650	.637	.626
2	.615	.605	.596	.587	.579	.571	.564	.557	.550	.544
3	.538	.536	.526	.521	.517	.511	.506	.501	.497	.493

The diameters of musket bores differ about 1-10th part from that of the bullet. The government allows 11 bullets in the pound, for the proof of muskets, and 14 in the pound, or 29 in 2 pounds, for service; 17 for the proof of carbines, and 20 for service; 28 in the pound for proof of pistols, and 34 for service.

DIAMETER of powder measures. See POWDER MEASURES.

DIGGING. See MINING.

DIKE. See DITCH. See FORTIFICATION.

DIMACHÆ, in *ancient military affairs*, were a kind of horsemen, answering to the dragoons of the moderns.

DIRECTION, in *military mechanics*, signifies the line or path of a body in motion, along which it endeavours to proceed, according to the force impressed upon it.

Angle of DIRECTION, that formed by the lines of direction of two conspiring powers.

Quantity of DIRECTION, a term used by military mathematicians for the product of the velocity of the common centre of gravity of a system of bodies, by the sum of their quantities of matter: this is no ways altered by any collisions among the bodies themselves.

DIRK, a kind of dagger used by the highlanders in Scotland, which they generally wear stuck in their belts.

DISCHARGE, in a *military sense*, is the dismissing a soldier from the troop or company he belonged to, either by his own request, or when, after long and faithful services, he is discharged, and intitled to his majesty's bounty.

DISCIPLINE, in a *general sense*, signifies instruction and government.

Military DISCIPLINE. } By *military constitution*. } By *military constitution*. } *tion* is meant, the authoritative declared laws for the guidance of all military men, and all military matters; and by *discipline* is meant, the obedience to, and exercise of, those laws. As health is to the natural body, so is a sound military constitution to the military one; and as exercise is to the first, so is discipline to the last. Bravery will

perchance gain a battle; but every one knows it must be training and discipline that will, and must win the long-disputed prize of a war.

The kingdom of Prussia is an example extant in favour of discipline; for since that state has raised an army, and maintained that army in strict discipline, it has held a very considerable share in the system of Europe; and should it neglect its army, it will sink from the kingdom of Prussia, into the electorate of Brandenburg.

Marine DISCIPLINE, is the training up soldiers for sea-service, in such exercises as the various positions of the firelock and body; and teaching them every manœuvre that can be performed on board ships of war at sea, &c.

DISMOUNTING, in a *military sense*, is the act of unhorsing. Thus, to dismount the cavalry, &c. is to make them alight.

To DISMOUNT cannon, is to break their carriages, wheels, axle-trees, or any thing else, so as to render them unfit for service. It also implies dismounting by the gin, &c.

DISPART, in *gunnery*, is to set a mark on the muzzle-ring, so that it may be of an equal height with the base-ring: hence a line drawn between them, will be parallel to the axis of the concave cylinder, for the gunner to take aim by it, to hit the mark he is to fire at; for the bore and this imaginary line being parallel, the aim so taken must be true. This exactness cannot be made use of in an engagement, and but very seldom at a siege; for there practice and the eye must be the only guides.

DISPART-frontlet. See FRONTLET.

DISPOSITION, in a *military sense*, is the just placing an army or body of men upon the most advantageous ground, and in the strongest situation for a vigorous defence.

DISTANCE of the bastions, in *fortification*, is the side of the exterior polygon. See FORTIFICATION.

DITCH. See FORTIFICATION.

To drain a DITCH, is to make the water run off

off into lower ground, by means of small trenches cut for this purpose.

DIVERSION, in *military history*, is when an enemy is attacked in one place where they are weak and unprovided, in order to draw off their forces from making an irruption somewhere else. See **STRATAGEMS**.

DIVISIONS of a *battalion*, are the several platoons into which a regiment or battalion is divided, either in marching or firing; each of which is commanded by an officer.

DIVISIONS of an *army*, are the number of brigades and squadrons it contains.

DIVINE service, in the *army*, is or should be performed every Sunday by the chaplain of the regiment, not purely on a moral, but pretty much on a political account.—All officers and soldiers, not having just impediment, shall diligently frequent divine service and sermon, in the places appointed for the assembling of the regiment, troop, or company, to which they belong: such as wilfully absent themselves, or, being present, behave indecently or irreverently, shall, if commissioned officers, be brought before a court-martial, there to be publicly and severely reprimanded by the president: of non-commissioned officers or soldiers, every person so offending, shall, for his first offence, forfeit 12d. to be deducted out of his next pay; for the second offence, he shall not only forfeit 12d. but be laid in irons for 12 hours, &c. *Art. of war*.

DODECAGON, in *geometry*, is a regular polygon, consisting of 12 equal sides and angles, capable of being regularly fortified with the same number of bastions.

DOG-nails. See **NAILS**.

DOLPHINS. See **CANNON**.

DOSSER, in *military matters*, is a sort of basket, carried on the shoulders of men, used in carrying the earth from one part of a fortification to another, where it is wanted.

DOWLEDGES,

DOWL-bars,

DOWL-pins,

} See **CARRIAGES**.

DOUBLE tenaille. See **TENAILLE**.

DOUBLING, in the *military art*, is the placing two or more ranks or files into one.

DOUBLE your ranks, is for the 2d, 4th, and 6th ranks (when so drawn up) to march into the 1st, 3d, and 5th; so that of 6 ranks they are made but 3; which is not so when they double by half-files, because then 3 ranks stand together, and the 3 other come up to double them; that is, the 1st, 2d, and 3d, are doubled by the 4th, 5th, and 6th, or the contrary.

DOUBLE your files, is for every other file to march into that which is next to it, on the right or left, as the word of command directs; and then the 6 ranks are doubled into 12, the men standing 12 deep; and the distance between the files is double what it was before. By this method 3 files may be doubled into 6, &c.

DRAGOONS, in *military affairs*, are a kind of horsemen, or cavalry, who serve both on horseback and foot; being always ready on every emergency, as being able to keep pace with the horse, and do the duty of foot. In battle, or on attacks, they generally fight sword in hand after the first fire. In the field they incamp on the right and left of the lines. They are divided into brigades, regiments, and squadrons. Their martial music is drums and trumpets. The first regiment of dragoons raised in England was in 1681, and called the royal regiment of dragoons of North Britain. This name is derived from the Latin word *Draconarii*, used amongst the Romans.

DRAG-ropes. See **ROPES**.

DRAUGHT-hooks, in a *gun-carriage*, are fixed to the transom-bolts on the cheeks of artillery carriages, near the trunnion-holes and trails: they are used to draw the guns backwards and forwards by men with drag-ropes fixed to those hooks. See **CARRIAGE**.

DRAW-bridge. See **BRIDGE**.

DRAWING, in a *military sense*, is the art of representing the appearances of all kinds of military objects by imitation, or copying, both with and without the assistance of mathematical rules.

DRAIN, or **DREIN**, in the *military art*, is a trench made to draw the water out of a ditch, which is afterwards filled with hurdles and earth, or with fascines, or bundles of rushes and planks, to facilitate the passage over the mud. See **TRENCH**.

DRESS-military. The clothing of the army is generally called regimentals, every part of which should facilitate, and not hinder, the various motions of the manual exercise. A soldier, without regard to fashion or taste, (to use the words of a modern author) should be dressed in the most comfortable and least embarrassing manner possible; and the keeping him warm, and leaving him the entire use of his limbs, are objects always to be had in view.

DRINKING to excess in the army is at all times highly criminal, but upon service is not to be pardoned; and the consequence will be a trial by a court-martial. It has been productive of almost innumerable mischiefs, and is a most detestable and horrid practice. What
ever

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ever commissioned officer shall be found drunk on his guard, party or other duty, under arms, shall be cashiered for it; any non-commissioned officer or soldier, so offending, shall suffer such corporal punishment as shall be inflicted by the sentence of a court-martial. *Art. of war.*

DRUM, is a martial musical instrument in form of a cylinder, hollow within, and covered at the two ends with vellum, which is stretched or slackened at pleasure, by means of small cords and sliding leathers. This instrument is used both by foot and dragoons; which is done in several manners, either to give notice to the troops of what they are to do, or to demand liberty to make some proposal to an enemy. Every troop of dragoons, and every company of foot or artillery, has two or more drums, as the men are in number. The drum was first invented by Bacchus, who, as Polyenus reporteth, fighting against the Indians, gave the signal of battle with cymbals and drums; and the Saracens, who invaded Christendom, introduced the drum into the European armies. The various beats are as follow, viz.

The general, is to give notice to the troops that they are to march.

The assembly, } is to order the troops to repair
The troop, } to the place of rendezvous, or to their colours.

The march, is to command them to move, always with the left foot first.

Tat-too, is to order all to retire to their quarters.

The reveille, is always beat at break of day, and is to warn the soldiers to rise, and the sentinels to forbear challenging, and to give leave to come out of quarters.

To arms, is for soldiers who are dispersed, to repair to them.

The retreat, is a signal to draw off from the enemy.

Retraite, is always beat in both camp and garrison a little before sun-set, at which time the gates are shut, and the soldiers repair to their barracks.

The alarm, is to give notice of sudden danger, that all may be in readiness for immediate duty.

The parley, } is a signal to demand some
The chamade, } conference with the enemy.

DRUM, or DRUMMER, the person who beats the drum.

Kettle-Drums, are two sorts of large basons of copper or brass, rounded at the bottom, and covered with vellum or goat-skin, which is

D U T

kept fast by a circle of iron, and several holes fastened to the body of the drum, and a like number of screws to stretch it at pleasure. They are used among the horse. The *kettle-drum* belonging to the royal regiment of artillery is mounted on a most superb and pompous waggon, richly gilt and ornamented, and drawn by 4 white horses elegantly caparisoned, with a seat for the drum-major-general.

DRUM-major, is always that person in the regiment, who beats the best drum, has the command over the other drums, and teaches them their duty. Every regiment has a drum-major.

DUEL, is a single combat, at a time and place appointed, in consequence of a cartel or challenge. Duelling was anciently authorised; but the motive of the duellists was the good of their country, when one, or a small number of combatants were chosen to save the blood of a whole army, and decide, by victory or death, the quarrels of kings or nations. Thus it was with Goliath and David, the Horatii and Curatii, and several others.

DUELLING was so general a method of determining differences among the nobles, that even ecclesiastics were not excused; only, to prevent their being stained with blood, they procured champions to fight for them. None were excepted from combat, but sick people, cripples, and such as were under 21 years of age, or above 60. Jufts and tournaments, doubtless, rendered duels more frequent.—No officer or soldier shall pretend to send a challenge to any other officer or soldier, to fight a duel, if a commissioned officer, on pain of being cashiered; if a non-commissioned officer or soldier, of suffering corporal punishment, at the discretion of a court-martial. *Art. of war.*

DUELLING was authorised before the Normans came into England, though not so frequent and solemn as after the conquest.

DUNGEON, } in *fortification*, is commonly
DONJON, } a large tower or redout of a fortress, whither the garrison may retreat, in case of necessity, and capitulate with greater advantage.

DUTY, in a *military sense*, is the exercise of those functions that belong to a soldier, yet with this nice distinction, that duty is counted the mounting guard, &c. where no enemy is directly to be engaged; for when any body of men marches to meet the enemy, this is strictly called *going upon service*.

E A G

On all duties, whether with or without arms, picquets, or court-martials, the tour of duty begins with the eldest downwards. An officer who is upon duty cannot be ordered for any

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other before that duty is finished, except he be on the picquet, as then he shall be relieved, and go on that duty ordered.

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EAGLE. *Black-EAGLE*, an order of military knighthood in Prussia, instituted by the elector of Brandenburg, in 1701, on his being crowned king of Prussia. The knights of this order wear an orange-coloured ribbon, suspending a black eagle.

White-EAGLE, is a like order in Poland, instituted in 1325, by Uladislaus V. on occasion of the marriage of his son Casimir to the daughter of the great duke of Lithuania. The knights of this order wear a chain of gold, suspending a silver eagle crowned.

EARTH-bags. See BAGS.

ECHARPE, in the *art military*. To batter *en echarpe*, is to fire obliquely, or sideways. See BATTERY.

ECHAUGETTE, in *military history*, signifies a watch-tower, or kind of centry box.

ECHO. See SOUND.

EDUCATION, in a *military sense*, implies the training up of youth to the art of war; wherein, first, should be understood, whether nature has given the young man the talents necessary for the profession or not; for here sense, parts, courage, and judgement, are required in a very eminent degree. The natural qualities of an officer, are, a robust constitution, a noble open countenance, a martial genius, fire to push action, phlegm to moderate his transports, and patience to support the toils and fatigues of war, without almost seeming to feel them. Birth and family, added to these advantages, never fail of commanding respect. Acquired qualities of an officer consist in moral virtues and sciences: by the first is meant, a regular good conduct, œconomy, prudence, and a serious application to what regards the service. Military sciences indispensably demand the reading of ancient and modern historians; a good knowledge of military mathematics, and the study of the chief languages of Europe.

It is in ancient authors we find all that is excellent, either in politics or war: the make and form of arms are changed since the inven-

tion of gun-powder; but the science of war is always the same. On one hand, history instructs us by examples, and furnishes us with proofs, of the beautiful maxims of virtue and wisdom, which morality has taught us: it gives us a kind of experience, before-hand, of what we are to do in the world; it teaches us to regulate our life, and conduct ourselves with wisdom; to distrust mankind; ever to carry ourselves with integrity and probity, never to do a mean action; and to measure grandeur with the level of reason, that we may despise it when dangerous or ridiculous.

On the other hand, history serves to give us a knowledge of the universe, and the different nations which inhabit it, their religions, their governments, their interests, their commerce, their politicks, and the law of nations. It shews us the origin of the illustrious houses who have reigned in the world, and given birth to those who still subsist.

The knowledge of military mathematicks; regards the operations of war in general; every thing there consists in proportion, measure, and motion: it treats of marches, encampments, battles, artillery, fortification, lines, sieges, mines, ammunition, provisions, fleets, and every thing which regards war; but no just notion can be acquired without geometry, natural philosophy, mechanics, military architecture, and the art of drawing.

The study of languages is most useful to an officer, and he feels the necessity of it, in proportion as he rises to higher employments. Thus the Latin, German, and French languages, are very necessary for an English officer; as the English, French, and Italian, are for a German.

EFFEctIVE men, in a *military sense*, are soldiers fit for service; as an army of 30,000 effective (fighting) men.

ELDER battalion. A battalion is counted *elder than another*, by the time since it was raised. See SENIORITY.

ELDER

ELDER officer, is he whose commission bears the oldest date. See SENIORITY.

ELEVATION, in *gunnery*, that comprehended between the horizon and the line of direction of either cannon or mortar; or it is that which the chace of a piece, or the axis of its hollow cylinder, makes with the plane of the horizon.

EMBRASURE, in *fortification*, is an opening, hole, or aperture in a parapet, through which the cannon are pointed to fire at the enemy. They are generally made from 10 to 12 feet distant from one another, every one of them being from 6 to 9 feet wide without, and 2 or $2\frac{1}{2}$ within: their height above the platform is $2\frac{1}{2}$ or 3 feet towards the town, and $1\frac{1}{2}$ foot on the other side towards the field, so that the muzzle of the piece may be sunk on occasion, and brought to fire low. See BATTERY. See FORTIFICATION.

EMINENCE, in the *military art*, a high or rising ground, which overlooks and commands the low places about it: such places, within cannon-shot of any fortified place, are a great disadvantage; for if the besiegers become masters of them, they can from thence fire into the place.

EMPATTEMENT, in *fortification*. See TALUS.

EMULATION, in a *military sense*, is a noble jealousy whereby gentlemen endeavour to surpass each other in the art of war, and military sciences. Is not the want of encouragement to excite emulation, the great cause of misconduct among military men? An officer who is not protected, who is never sure of the least favour, neglects himself, and takes less trouble to acquire glory, rarely heard of, though merited by the bravest actions, than to enjoy the tranquillity of an ordinary reputation. Brave actions, whoever are the authors, should never be buried in oblivion, as they excite emulation, and are full of instruction.

ENCAMPMENT, the pitching of a camp. See CAMP.

ENCEINTE, in *fortification*, is the interior wall or rampart which surrounds a place, sometimes composed of bastions or curtains, either faced or lined with brick or stone, or only made of earth. The *enceinte* is sometimes only flanked by round or square towers, which is called a Roman wall.

ENCOUNTERS, in *military affairs*, are combats, or fights, between two persons only. Figuratively, battles or attacks by small or

large armies. The marquis de Feuquieres mentions four instances of particular encounters brought on by entire armies, with a design to create a general engagement, English edition, vol. 1. p. 304. &c.

ENEMY, in a *military sense*, one who is of an opposite side in war, or who publicly invades the kingdom.

ENFANS perdus, in *military history*, are soldiers detached from several regiments, or otherwise appointed to give the first onset in battle, or an attack upon the counterscarp, or the breach of a place besieged; so called (by the French) because of the imminent danger they are exposed to.

ENFILADE, in *fortification*, is used in speaking of trenches, or other places, which may be scoured by the enemy's shot, along their whole length. In conducting the approaches at a siege, care must be taken that the trenches be not *enfiladed* from any work of the place. See TRENCHES.

To **ENFILADE**, is to sweep the whole length of any work or line of troops with the shot of artillery or small arms.

ENGINES, in *military mechanics*, are compound machines, made of one or more mechanical powers, as levers, pulleys, screws, &c. in order to raise, project, or sustain any weight, or produce any effect which could not be easily effected otherwise. Engines used in war are extremely numerous, as the battering-ram, ballista, waggons, chariots, &c.

ENGINE, to *drive fuzes*, consists of a wheel with a handle to it, to raise a certain weight, and to let it fall upon the driver, by which the strokes become more equal.

ENGINE to *draw fuzes*, has a screw fixed upon a three-legged stand, the bottom of which has a ring to place it upon the shell; and at the end of the screw is fixed a hand-screw by means of a collar, which being screwed on the fuze, by turning the upper screw, draws out or raises the fuze.

ENGINEER, is commonly applied to an officer who is appointed to inspect and contrive any attacks, defences, &c. of a fortified place, or to build or repair them, &c.

The art of fortification is an art which stands in need of so many others, and whose object is so extensive, and its operations accompanied with so many various circumstances, that it is almost impossible for a man to make himself master of it by experience alone, even supposing him born with all the advantages of genius and disposition possible for the knowledge

ledge and practice of that important art. We do not pretend to deny that experience is of greater efficacy than all the precepts in the world; but it has likewise its inconveniences as well as its advantages: its fruits are of slow growth; and whoever is content with pursuing only that method of instruction, seldom knows how to act upon emergencies of all kinds, because old age incapacitates him from exercising his employment. Experience teaches us, thro' the means of these errors we commit ourselves, what theory teaches us at the expence of others. The life of man being short, and opportunities of practice seldom happening, it is certain nothing less than a happy genius, a great share of theory, and intent application joined to experience, can make him one day shine in his profession. From whence it follows, that less than the three first of those four qualities, should not be a recommendation for the reception of a young gentleman into the corps of engineers.

The fundamental sciences, and those absolutely necessary, are arithmetic, geometry, mechanics, hydraulics, and drawing. Without arithmetic it is impossible to make a calculation of the extent, and to keep an account of the disbursements made, or to be made; nor without it can an exact computation be made upon any occasion whatsoever.

Without geometry it is impossible to lay down a plan or map with truth and exactness, or settle a draught of a fortification, or calculate the lines and angles, so as to make a just estimation, in order to trace them on the ground, and to measure the surface and solidity of their parts.

Mechanics teach us the proportions of the machines in use, and how to increase or diminish their powers as occasion may require; and likewise to judge whether those which our own imagination suggests to us, will answer in practice.

Hydraulics teach us how to conduct waters from one place to another, to keep them at a certain height, or to raise them higher.

How fluently soever we may express ourselves in speaking or writing, we can never give so perfect an idea as by an exact drawing: and often in fortification both are wanted; for which reason the art of drawing is indispensably necessary for engineers.

To the qualities above mentioned must be added activity and vigilance; both which are absolutely necessary in all operations of war, but especially in the attack of such places as are in expectation of succours. The besieged

must have no time allowed them for consideration; one hour lost at such a juncture often proves irreparable. It is by their activity and vigilance that engineers often bring the besieged to capitulate, much sooner than they would have done if those engineers had not pushed on the attack with firmness and resolution. Want of vigilance and activity often proceed from irresolution, and that from weakness of capacity.

As the office of an engineer requires great natural qualifications, much knowledge, study, and application, it is but reasonable that the pay should be proportioned to that merit which is to be the qualification of the person employed: he must be at an extraordinary expence in his education, and afterwards for books and instruments for his instruction and improvement, as well as for many other things; and that he may be at liberty to pursue his studies with application, he must not be put to shifts for necessaries. It should likewise be considered, that if an engineer do his duty, be his station what it will, his fatigue must be very great; and, to dedicate himself wholly to that duty, he should be divested of all other cares.

The word Engineer is of modern date, and was first used about the year 1650, when one Capt. Thomas Rudd had the title of chief engineer to the king. In 1600 the title given to engineers was trench-master; and in 1622 Sir William Pelham, and after him Sir Francis Vere, acted as trench-masters in Flanders. In the year 1634 an engineer was called camp-master general, and sometimes engine-master, being always subordinate to the master of the ordnance.

At present the corps of engineers consists of

- 1 Colonel in chief;
- 2 Directors, or lieutenant-colonels;
- 4 Sub-directors, or majors;
- 12 Engineers in ordinary, or captains;
- 12 Engineers extraordinary, or captains;
- 14 Sub-engineers, or lieutenants;
- 24 Practitioner engineers, or second lieutenants; exclusive of the engineers on the Irish establishment, which are but few.

ENNEAGON, in *geometry*, or *fortification*, is a figure consisting of 9 angles, and as many sides, capable of being fortified with the same number of bastions.

ENSIGN, in the *military art*, a banner, under which the soldiers are ranged according to the different regiments they belong to. See COLOURS.

ENSIGN, or *ensign-bearer*, is an officer who carries

carries the colours, being the lowest commissioned officer in a company of foot, subordinate to the captain and lieutenant. The word *ensign* is very ancient, being used both by the Greeks and Romans, and amongst both foot and horse. Ensigns belonging to the foot, were either the common one of the whole legion, or the particular ones of the manipuli. The common ensign of the whole legion was an eagle of gold or silver fixed on the top of a spear, holding a thunderbolt in her talons, as ready to deliver it. That this was not peculiar to the Romans, is evident from the testimony of Xenophon, who informs us, that the royal ensign of Cyrus was a golden eagle spread over a shield, and fastened on a spear, and that the same was still used by the Persian kings. In the rustic age of Rome, the ensigns were nothing more than a wisp of hay carried on a pole, as the word *manipulus* properly signifies. The ensign of the horse was not solid, as the others, but a cloth, somewhat like our colours, spreading on a staff; on which the names of the emperors were generally depicted. The religious care the soldiers took of the ensigns, was extraordinary: they worshipped them, swore by them (as at present several European powers do) and incurred certain death if they lost them. The Turks and Tartars make use of horses tails for their ensigns, whose number distinguishes the rank of their commanders; for the Sultan has 7, and the Grand Vizier only 3, &c.

ENTERPRISE, in *military history*, an undertaking attended with some hazard and danger.

ENTERPRISER, an officer who undertakes or engages in any important and hazardous designs. This kind of service frequently happens to the light-infantry, light-horse, and hussars.

ENTREVLOPP, in *fortification*, a work of earth, sometimes in form of a single parapet, and at others like a small rampart: it is raised sometimes in the ditch, and sometimes beyond it. They are sometimes *en zig-zac*, to inclose a weak ground, where that is practicable, with single lines, to save the great charge of horn-works, crown works, and tenailles, or where room is wanting for such large works. These sorts of works are to be seen at Besançon, Dovay, Luxembourg, &c. Envelopes in a ditch are sometimes called *fillons*, *contre-gardes*, *conservees*, *lanettes*, &c. which words see.

EPAULE, in *fortification*, denotes the shoulder of a bastion, or the place where its face and flank meet, and from the angle, called the

angle of the shoulder. See **FORTIFICATION**.

EPAULEMENT, in *fortification*, is a kind of breast-work to cover the troops in front, and sometimes in flank. In a siege, the besiegers generally raise an epaulement of 8 or 10 feet high, near the entrance of the approaches, to cover the cavalry, which is placed there to support the guard of the trenches. These works are sometimes made of filled gabions, or fascines and earth. This term is frequently used for any work thrown up to defend the flank of a post, or any other place. See **FORTIFICATION**. It is sometimes taken for a demi-bastion, and at other times for a square orillon to cover the cannon of the casemate.

EPAULETTES, are a kind of shoulder-knots; those for the soldiers, to be of the colour of the facing, with a narrow yellow or white tape round it, and worsted fringe; those for the officers are made of gold or silver lace, with rich fringe. They are badges of distinction worn on one or both shoulders.

EPROUVETTE, is a machine to prove the strength of gunpowder. They are of different sorts, according to the fancy of different nations who use them. Some raise a weight, and others throw a shot, to certain heights and distances.

EPTAGON. See **HEPTAGON**.

EQUESTRIAN statue, in *military history*, signifies the person of any great warrior mounted on horseback.

EQUESTRIAN order, among the Romans, signified their knights or equites; as also their troopers or horsemen in the field; the first of which orders stood in contradistinction to the senators, as the last did to the foot: each of these distinctions was introduced into the state by Romulus.

EQUIPAGE, in a *military sense*, is all kinds of furniture made use of by the gentlemen of the army; such as

Comp-^{le} Equipage, } are tents, kitchen-furniture, saddle-horses, baggage-waggons, bat-horses, &c.

This kind is not determined in our service, neither in regard to quantity or quality; but in the Prussian army is as follows, viz.

INFANTRY.

1. The field-marshal general shall take into the field, on chaise or coach, with six horses to draw it; 2 baggage waggons; 4 chaise-machines, and as many bat-horses, mules, and saddle-horses, as he pleases.

2. A general of foot, 1 chaise or coach with 6 horses; 1 baggage-waggon; 3 chaise-machines;

rines; 12 bat-horses, or mules; and as many saddle-horses as he pleases.

3. A lieutenant-general, 1 chaise or chariot, with 4 horses; 1 baggage-waggon; 8 bat-horses, or mules; and as many saddle-horses as he pleases.

4. A major-general, 1 chaise with four horses; 1 baggage-waggon; 1 chaise marine; 6 bat-horses, or mules; and 6 saddle-horses.

5. A colonel, 1 chaise with 2 horses, or 4 at most; 2 chaise-marines; 6 bat-horses, or mules; and 4 saddle-horses.

6. A lieutenant-colonel, 1 chaise, with 2 horses; 1 chaise-marine; 4 bat-horses, or mules; and 3 saddle-horses.

7. A major, 1 chaise-marine; 4 bat-horses, or mules; and 3 saddle-horses.

8. A captain is only allowed 1 baggage-waggon for the company, 1 for himself, 1 bread-waggon, and 2 saddle-horses.

9. No subaltern officer shall have a waggon, and is allowed only 1 bat-horse, and 1 saddle-horse.

N. B. All the chaise-marines are coloured alike, and the name of their respective regiments painted upon them; as also every general's name is painted in like manner upon the baggage-waggons and chaise-marines which belong to them.

CAVALRY.

1. A general of the horse shall take into the field, 1 chaise or coach, with 6 horses; 1 baggage-waggon; 3 chaise-marines; 12 bat-horses, or mules; and as many saddle-horses as he pleases.

2. A lieutenant-general, 1 chaise or chariot, with 4 horses; 1 baggage-waggon; 2 chaise-marines; 8 bat-horses, or mules; and as many saddle-horses as he pleases.

3. A major-general, 1 chaise, with 4 horses; 1 baggage-waggon; 1 chaise-marine; 6 bat-horses, or mules; and 8 saddle-horses.

4. A colonel, 1 chaise, with 2 horses, or at most 4; 2 chaise-marines; 6 bat-horses, or mules; and 6 saddle-horses.

5. A lieutenant-colonel, shall take 1 chaise-marine; 4 bat-horses, or mules; and 5 saddle-horses.

6. A major, 1 chaise-marine; 4 bat-horses, or mules; and 4 saddle-horses.

7. A captain, 2 chaise-marines, 1 for his troop, and the other for himself; and 3 or 4 saddle-horses.

8. The subaltern officers, 2 saddle-horses, and 1 bat-horse; but are positively not to have waggons; and all such as are provided contrary to this regulation, shall be burnt.

N. B. The chaise-marines, and baggage-waggons shall be painted and coloured as above. The bat-horses for the infantry, and troop-tents, are exclusive of these.

ESCALADE. See SCALADE.

ESCARPE, is the outward slope or talus of the rampart.

ESCORT, in the *art of war*. See CONVOY.

ESCOUADE. See SQUADS.

ESPADON, in old *military books*, a kind of two-handed sword, having two edges, of a great length and breadth; formerly used by the Dutch.

ESPLANADE, in *fortification*, the sloping of the parapet of the covert-way towards the field, and is therefore the same as the glacis of the counterescarp; but begins to be antiquated in that sense, and is now only taken for the empty space between the glacis of a citadel, and the first houses of the town.

ESPONTON. See SPONTOON.

ESPRINGAL, in the *ancient art of war*, a machine for throwing large darts, generally called muchettæ.

ESQUADE. See SQUADS.

ESSÉS, in the *train of artillery*, are fixed to draught-chains made in the form of an S, one end of which is fastened to the chain, and the other to hook to the horse's harness, or to a staple: they serve likewise to lengthen and piece chains together.

ESTOILE. See STAR-REDOUT, STAR-FORT.

ETAPPE, a term used in *military history*, taken from the French; which signifies the quantity of provisions and forage allowed in an army, in marching through a kingdom, whether going into winter-quarters, or taking the field.

ETAPPIER, in *military history*, is the person that contracts with the country or territory for furnishing troops in their march with provisions and forage, &c.

EVACUATE, in *military history*, a term made use of in the articles of capitulation granted to the besieged at the time they surrender to the besiegers; and is the same as quitting a place.

EVOLUTION, in the *art of war*, the motion made by a body of troops, when they are obliged to change their form and disposition, in order to preserve a post, occupy another, to attack an enemy with more advantage, or to be in a condition of defending themselves the better. That evolution is best which, with a given number of men, may be executed in the least

space,

space, and consequently in the least time possible.

EVOLUTIONS of the moderns, is a change of position, which has always for its object either offence or defence. The essentials in the performance of an evolution are, order, directness, and the greatest possible rapidity. In short, evolutions implies any body of troops marching to charge rapidly, and in good order; totally dispersing, and forming with the utmost readiness; wheeling in all its divisions; doubling in all ways; or, in other words, forming a column or columns from all points of its front.

EVOLUTIONS of the ancients, were their ready marching, wheeling, and forming into every position practised in those days, &c.

EXAGON. See **HEXAGON**.

EXECUTION, Military **EXECUTION**, is the pillaging or plundering of a country by the enemy's army.

Military EXECUTION, also means every kind of punishment inflicted on the army by the sentence of a court-martial; which is of various kinds, such as tying up to 3 halberts, and receiving a number of lashes with a whip, composed of 9 whip-cord lashes, and each lash of 9 knots, from the drummer: or running the gantlope through the parade at guard-mounting, drawn up in 2 lines for that purpose; when the provost marches through with twigs or switches, and every soldier takes as many as there are prisoners to be punished: the prisoner then marches through the 2 lines, and each soldier gives him a hard stroke, the major riding up and down to see that the men lay on properly. When a soldier is to be punished with death, a detachment of about 200 men from the regiment he belongs to forms the parade, when a file of grenadiers shoots the prisoner to death. N. B. Every nation has different methods of punishment.

EXERCISE, in *military affairs*, the practice of all those motions and actions, together with the whole management of arms a soldier is to be perfect in, to render him fit for service, and make him understand how to attack and defend, as exercise is the first part of the military art; and the more it is considered, the more essential it will appear. It frees their bodies from the rusticity of simple nature, and forms men and horses to all the evolutions of war. Upon it depend the honour, merit, appearance, strength, and success of a corps; while we see the greatest armies, for want of being exercised, instantly disordered, and that disorder increasing in spite of command: the confusion oversets the art of skilful masters, and the valour of the men only

serves to precipitate the defeat: for which reason it is the duty of every officer to take care that the recruits be drilled as soon as they join their corps.

The greatest advantage derived from the exercise, is the expertness with which men become capable of loading and firing, and their learning an attention to act in conformity with those around them. It has always been lamented, that men have been brought on service, without being informed of the uses of the different manœuvres they have been practising; and that, having no ideas of anything but the uniformity of the parade, they instantly fall into disorder and confusion when they lose the step, or see a deviation from the straight lines they have been accustomed to at exercise. It is a pity to see so much attention confined to show, and so little given to instruct the troops in what may be of use to them on service. Though the parade is the place to form the characters of soldiers, and teach them uniformity, yet being confined to that alone, is too limited and mechanical for a true military genius.

The great loss that our troops sustained in Germany, America, and the West-Indies, during the last war, from sickness, and not from the enemy, was chiefly owing to a neglect of exercise. An army, whose numbers vanish after the first 4 months of a campaign, may be very ready to give battle in their existing period; but the fact is, that although fighting is one part of a soldier's business, yet bearing fatigue, and being in health, is another, and at least as essential as the first. A campaign may pass without a battle; but no part of a campaign can be gone through without fatigue, without marches, without an exposure to bad weather; all of which have exercise for their foundation; and if soldiers are untrained to these matters, and sink under them, they are corporeally incapable of rendering much service to their king and country.

It is not from numbers, or from inconsiderate valour, that we are to expect victory; in battle she commonly follows capacity, and a knowledge of arms. We do not see that the Romans made use of any other means to conquer the world, than a continual practice of military exercises, an exact discipline in their camps, and a constant attention to cultivate the art of war. Hence, both ancients and moderns agree, that there is no other way to form good soldiers but by exercise and discipline; and it is by a continual practice and attention to this, that the Prussians have arrived at that point

point of perfection so much admired in their evolutions, and manual exercise.

Infantry EXERCISE, } as appointed by his ma-
Manual EXERCISE, } jesty, consist in the words of command for that purpose. When a regiment is drawn up or paraded for exercise, the men are placed 3 deep, either by companies, or divided into platoons, with the grenadiers on the right; and in order to have the manual exercise well performed, it is in a particular manner requisite, that the ranks and files be even, well dressed, and the file-leaders well covered: this must be very strictly attended to both by the major, and his adjutant: all officers also, on service in general, where men are drawn up under arms, or without, must be careful that the ranks and files are exactly even; and the soldiers must learn to dress themselves at once, without the necessity of being directed to do it. The beauty of all exercise and marching consists in seeing a soldier carry his arms well, keep his firelock steady and even upon his shoulder, the right hand hanging down, and the whole body without constraint.—The firelocks, when shouldered, should be exactly dressed in rank and file; the men must keep their bodies upright, and in full front, not having one shoulder too forward, or the other too backward. The distances between the files must be equal, and not greater than from arm to arm, which gives the requisite room for the motions. The ranks are, or should be, 8 feet distant from each other. Every motion must be done with life, and all facings, wheelings, and marchings, performed with the greatest exactness. Hence a regiment should never be under arms longer than 2 hours. See MANOEUVRES, REGIMENT, FIRINGS.

Cavalry EXERCISE, is of two sorts, on horse-back, and on foot. The squadrons for exercise are sometimes drawn up 3 deep, though frequently but 2 deep; the tallest men and horses in the front, and so on. When a regiment is formed in squadrons, the distance of 24 feet, as a common interval, is always to be left between the ranks; and the files must keep boot-top to boot-top. The officers commanding squadrons must, above all things, be careful to form with great celerity, and, during the whole time of exercise, to preserve their given distances. In all wheelings, the flank which wheels, must come about in full gallop. The men must keep a steady seat upon their horses, and have their stirrups at a fit length, to make a large and sure stroke with their sword in time of action.

Artillery EXERCISE, is the method of teach-

ing the regiments of artillery the use and practice of all the various machines of war, viz.

EXERCISE of the light field-pieces, teaches the men to load, ram, and sponge the guns well; to elevate them, according to the distance, by the quadrant and screw; to judge of distances and elevations without the quadrant; how to use the port-fire, match, and tubes for quick firing; how to fix the drag-ropes, and use them in advancing, retreating, and wheeling with the field-pieces; how to fix and unfix the trail of the carriage on the limbers, and how to fix and unfix the boxes for grape-shot on the carriages of each piece.

EXERCISE of the garrison and battering artillery, is to teach the men how to load, ram, and sponge; how to handle the hand-spikes in elevating and depressing the metal to given distances, and for ricochet; how to adjust the coils, and work the gun to its proper place; and how to point and fire with exactness, &c.

Mortar EXERCISE, is of 2 different sorts, viz. with powder and shells unloaded, and with powder and shells loaded; each of which is to teach the men their duty, and to make them handy in using the implements for loading, pointing, travelling, and firing, &c. See PRACTICE.

Lowitz EXERCISE, differs but little from the mortar, excepting its being liable to various elevations; whereas that of the mortar is fixed to an angle of 45° but the men should be taught the method of ricochet-firing, and how to use them for grape-shot, &c. See PRACTICE.

EXERCISES, are also understood of what young gentlemen or cadets learn in the military academies and riding-schools; such as fencing, dancing, riding, the manual exercise, &c.

EXPEDITIONS, in a *military sense*, implies quickness, applied to time, motion, marching, or attacking an enemy, &c. An expedition is in some measure like a battle; requires quick resolves, and rapid execution: it is out of the nature of the thing itself to lay down fixed rules for the minute conducting of small expeditions; their first principles only can be with certainty fixed, and men will often disagree about preparations, and differ in their conduct, though they acknowledge the same principles.

One of the principles of many small expeditions, is surprise; and 6 battalions, without much accompaniment, may sometimes do that which 24, and a great fleet, would not succeed in.

There is no part of war so interesting to an

insulinary soldier as an expedition; nor can there be any part more worthy of attention.

EXPEDITIONS hitherto have had no rules laid down for their conduct, and that part of war has never been reduced to a system. The flow rules of a great war will not do in expeditions; the stroke must be struck with surprise, and affright have dominion before succours come. Debate is out of season, and all slow proceedings are ruin. Not to advance, is to recede; and not to be on the road to conquest, is to be already conquered. There must be that glance, which sees certainly, though instantly; that rapidity, which executes on the surest rules, when it seems least to act on any.

In all small expeditions, such as expeditions of surprise, or *coups-de-main*, the favourable side of the proposed action must ever be viewed; for if what may happen, what may arrive, what may fall out, is chiefly thought upon, it will, at the very best, greatly discourage, but in general end in a total failure. Hence the very name of an expedition implies risk, hazard, precarious warfare, and a critical operation.

An expedition implies five things.

1st, A secrecy, if possible, of preparation, and concealment of design, &c.

2dly, That the means bear proportion to the end. In this there will ever be a difference in opinion.

3dly, A knowledge of the state and situation of the country, where the scene of action is, or the place or object that is to be attacked.

4thly, A commander who has the particular turn of mind, which is most adapted to such particular sort of warfare.

Lastly, The plan of an expedition, great or small, is ever to be arranged as much as possible before setting out, and then any appearances that may vary a little from what might have been expected, will not perplex.

EXPERIMENTS, in a *military sense*, are the trials, results, or effects, of the applications of any kind of military machines, in order to discover their effects or motions, and relations, whereby to ascertain some of their real uses, or causes, &c. See PRACTICE.

FLYE-belts. See BOLTS.

F

FAÇADE, in *military fortification*. See FACE.

FACE, in *fortification*, is an appellation given to several parts of a fortress; as the

FACE of a *bastion*, the two front sides, reaching from the flanks to the salient angle of the bastion. See FORTIFICATION.

Prolonged FACE, that part of the line of defence razant, which is between the angle of the shoulder, and the curtain, or the line of defence razant, diminished by the length of the face of the bastion. See FORTIFICATION.

FACE of a *place*, is the front comprehended between the flanked angles of two neighbouring bastions, composed of a curtain, two flanks, and two faces; and is sometimes called the *Tenaille of the place*.

FACE of a *gun*, is the superficies of the metal at the extremities of the muzzle of the piece.

FACE, in *tactics*, a word of command in the manual exercise of troops, intimating to turn about: thus,

FACE to the right, is to turn upon both heels a quarter-round to the right.

FACE to the left, is to turn upon both heels a

quarter-round to the left. The same takes place with the cavalry, &c.

FAGGOTS, in *military history*, are men hired to muster by officers whose companies are not complete, to cheat the sovereign of so many men's pay.

FAGGOTS. See FASCINES.

FALCON, or *Faucon*, an ancient name given to a 3-pounder. See CANNON.

FALCONET, an ancient name given to a 1½-pounder. See CANNON.

FALSE attack. See ATTACK.

FALSE alarm. See ALARM.

FANION, or *Fannon*. See BANNER.

FASCINES, in *fortification*, are a kind of faggots, made of small branches of trees or brush-wood, tied in 3, 4, 5 or 6 places, and are of various dimensions, according to the purposes intended. Those that are to be pitched over, for burning lodgments, galleries, or any other works of the enemy, should be 1½ or 2 feet long. Those that are for making epaulements or chandeliers, or to raise works, or fill up ditches, are 10 feet long, and 1 or 1½ feet in diameter. They are made as follows:

fix

six small pickets are struck into the ground, 2 and 2, forming little crosses, well fastened in the middle with willow bindings. On these trestles the branches are laid, and are bound round with withes at the distance of every 2 feet. Six men are employed in making a fascine; 2 cut the boughs, 2 gather them, and the remaining 2 bind them. These 6 men can make 12 fascines every hour. Each fascine requires five pickets to fasten it.

FATHOM, in *fortification*, did originally denote that space a man can reach when both his arms are extended; but now means a measure of 6 feet or 2 yards, equivalent to the French word *toise*.

FAUCON. See FALCON.

FAUCONET. See FALCONET.

FAUSSE-BRAY, in *fortification*, is a low rampart going quite round the body of the place: their height is about 3 feet above the level ground, and its parapet about 3 or 4 toises from that of the body of the place. These works have been entirely rejected by the modern engineers, excepting M. Vauban, who makes them only before the curtains; and then they are called more properly *tenailles*.

FELLES, in *artillery*, are the parts of a wheel which form its circumference, whose dimensions are as follow: for a 24-pounder, 5 inches thick, and 6.5 inches broad; for a 12-pounder, 4.5 inches thick, and 6 inches broad; for a 6-pounder, 4 inches thick, and 5.5 inches broad, &c. made of dry elm. There are generally 6 in each wheel. See WHEEL.

FENCING, in the *military art*, is that of making a proper use of the sword, as well for attacking an enemy, as for defending one's self. Fencing is a genteel exercise, of which no military gentleman should be ignorant. It is learned by practising with steel foils. See FOILS.

Fencing is either simple, or compound. Simple is that performed nimbly, and off-hand, on the same line. In this the principal intention, in respect to the offensive part, should be to attack the enemy in the most unguarded part; and in the defensive, to parry or ward off the enemy's thrusts or blows.

Guard, in FENCING, implies a posture proper to defend the body from the sword of the antagonist, and is of various denominations.

Attitude, in FENCING, the head upright, though the body hath a forward inclination on a longe, and all the weight resting on the left haunch when on guard. The feet, hand, body, arm and sword, must be to the line.

Appels, in FENCING, is a sudden beat of your blade, on the contrary side to that you join your adversary on, and a quick disengagement to that side again.

Beating, in FENCING, is when you parry with a sudden short beat, to get a quick repost; or when you beat with your foot, to try if you are firm on it, or on both feet.

Battering, in FENCING, is to hit your adversary's blade on the side opposite to that you join, &c.

Back-quarte, is a parade of a late invention, and is a round quarte over the arm.

Carte, in FENCING, is a tierce on a quarte side, also the thrust of a prime, or a second, at the low quarte side.

Darting, in FENCING, to defend a blow with some contraction of your arm, and to dart a thrust right forward.

Faint forward, in FENCING, made by advancing your point a little from its line, and coming to it again.

Guard, in FENCING, is any of the parades you stand on.

On guard, is being placed on your feet, and well covered with your weapon.

Hanging guard, is one of the backsword guards, in form of second.

Inside guard, one of the backsword guards, in form of a quarte.

Lurching, in FENCING, to make an opening, to invite your adversary to thrust at you, when you, being ready, may find a favourable repost at him.

Locking, in FENCING, is to seize your adversary's sword arm by twining your left arm round it, after you close your parade, shell to shell, in order to disarm him.

Guard in $\left\{ \begin{array}{l} \text{carte,} \\ \text{tierce,} \\ \text{quatre,} \end{array} \right\}$ implies the putting of the body and sword in such a state of defence, as to prevent the antagonist from wounding you.

Thrust in FENCING, the thrust *in carte*, is to throw your hand as far as you can inside, with the point of your sword towards your adversary's breast. *To thrust seconde*, is to have your arm in a perfect opposition to your adversary's, holding your head inside. *To thrust tierce*, differs from *carte* only, by the position of the hand, which must be reversed.

Parrying, in FENCING, the action of warding off the blows aimed at each other.

Flanconade, in FENCING, is the action of dropping the point of your sword under your adversary's hilt, in seizing with force the feeble of his blade; which binding, without quitting it, forms

F I L

form the parade in octave, and then throw in your thrust.

Glizade, in *Fencing*, is performed by dexterously making your sword slip along your adversary's blade, and forming at the same time your extension, &c.

FEU de joie. See *RUNNING-FIRE*.

FICHANT. See *LINE OF DEFENCE*, *FORTIFICATION*.

FIELD-	{	Colours,	{	Camp-colours.
		Officers,		Officers.
		Pieces,		Cannon.
		Staff,		Lintstock.
		Works,		Field-fortification.

FIELD-marshal, a modern military rank in England, but superior to all others; having the chief command of the whole army.

FIGHT. See *BATTLE*.

FIGURE, in *fortification*, the plan of any fortified place, or the interior polygon. Of this there are two sorts, regular, and irregular: a regular figure is that where the sides and angles are equal; an irregular one is the contrary.

FILE, in the *art of war*, is an unlimited term, comprehending any number of men, drawn up in a direct line behind each other; as a rank, on the other hand, includes any number drawn beside each other; whether, in either respect, they be in close or open order. Or rather, by *file* is meant the line of soldiers standing one behind another, which makes the depth of the battalion; and is thus distinguished from the rank, which is a line of soldiers drawn up side by side, forming the length of the battalion. A file is 3 deep; hence a battalion or regiment drawn up, consists of 3 ranks, and of as many files as there are men in a rank.

FILE-leader, is the soldier placed in the front of any file, or the man who is to cover all those that stand directly in the rear of him, and by whom they are to be guided in all their movements. The files of a battalion of foot were formerly 12 and 6 deep; but now only 3, and sometimes 2 deep. Those of the cavalry are generally but 2 deep.

To double the FILES, is to put 2 files into 1, making the depth of the battalion double to what it was, not in the space of ground, but in number of men.

To FILE off, } to wheel off from marching in

To defile, } a spacious front and march in length by files. When a regiment is marching in full front, or by divisions or platoons, and comes to a defile or narrow pass, it may file off to the right or left as the ground requires, &c.

FIRE, in the *art of war*, a word of command to soldiers of all denominations, to discharge their fire-arms, grenades, cannon, &c.

F I R

FIRE-arms, are all kinds of arms charged with powder and ball; every one of which is mentioned in their respective articles.

Running-FIRE, is when a rank or ranks of men, drawn up, fire one after another; or when the lines of an army are drawn out to fire on account of a victory; when each squadron or battalion takes it from that on its right, from the right of the first line to the left, and from the left to the right of the second line, &c.

FIRE-balls. See *BALLS*.

FIRE-master, in our royal regiment of artillery, is an officer of rank and dignity, who, besides the post he enjoys in the regiment, has 150*l.* for his office. He gives the directions and proportions of all ingredients for each composition required in fire-works, whether for the service of war, or for rejoicings and recreations.

FIRE-master's mate, is always an officer in the royal regiment of artillery, who, besides the post he bears in the regiment, has 30*l.* a year for this office. His duty is, to aid and assist the chief fire-master, and he should be skilled in every kind of laboratory work.

FIRE-pots, in the *military art*, small earthen pots, into which is put a charged grenade, and over that, powder enough to cover the grenade; the whole covered with a piece of parchment, and two pieces of quick-match across lighted: it breaks and fires the powder, as also the powder in the grenade, which has no fuze, that its operations may be quicker: it burns all that is near it.

FIRE-works, are particular compositions of different sorts, made with sulphur, salt-petre, and charcoal. They are used in war, and on rejoicing-days.

FIRE-workers, were formerly subordinate to the fire-master and his mate; had afterwards the rank of youngest lieutenants to the royal regiment of artillery; but now that rank is abolished, and they are all second lieutenants. They were supposed to be well skilled in every kind of laboratory-work, which knowledge is an essential qualification in every officer of that regiment.

FIRE-locks, so called from their producing fire of themselves, by the action of the flint and steel; the arms carried by a foot-soldier: they are 3 feet 8 inches in the barrel, and with the stock 4 feet 8 inches; and carry a leaden bullet of which 29 make 2*lb.* its diameter is .550 of an inch, and that of the barrel 1-50th part of the shot. Fire-locks were first made use of in 1690, when match-locks were universally disused; but when invented, we cannot ascertain. A firelock is called, by writers of about the middle of the last century, *asnapbaan*, which being a Low-dutch word, seems to indicate its being a Dutch invention.

FIRINGS,

FIRINGS, in the *military art*, are of various sorts and denominations. At present we have no less than 8 or 9 different methods of firing in battalion; and as they cannot be all good, some one of them must be the best, both in regard to offensive and defensive firings; and if so, the others must in course be inferior to this. The object of firing is to do the most execution to the enemy: hence there must be some method of firing in battalion, and against battalion, more effectual than, and if so, preferable to the others. Let us attempt in some measure to determine which of these methods is the best. The present method of firing by platoons, cannot, we imagine, be the most effectual fire possible; because there are so many platoons to fire after each other, that the men must always load much faster than they are called on to fire: so that we have continually observed one of these platoons, after firing, to load again, and then remain so while one might with moderate quickness count from 180 to 260, i. e. about $3\frac{1}{4}$ minutes before it becomes its turn to fire again. This is totally inconsistent with, and contradictory to, every one's ideas of a proper fire. The reason generally given for firing by platoons, is that a constant and perpetual fire shall always be kept up. How ever true this reason may be, we apprehend it will neither require nor defend the present method of platoon-firing; since a more numerous and effectual fire may be made, and also kept up so as to be perpetual. In the Prussian army, the men are taught to load with the utmost quickness; and we are well assured that they are more expeditious, both in loading and firing, than most other armies are; which perhaps one may be the more ready to conceive, from observing with how much greater expedition some of our own regiments perform than others.

Platoon-FIRING, consists in three different methods, viz. standing, advancing, and retreating. Preparative to every kind of firing, each regiment or battalion must be told off in grand-divisions, sub-divisions, and platoons; exclusive of the grenadiers, which form 2 subdivisions or 4 platoons of themselves. In firing standing, whether by divisions or platoons, the first fire is from the division or platoon on the right; the second fire, from the left; the third fire, from the right again; and so on alternatively until the firing comes to the centre platoon, which is generally called the colour platoon, and does not fire, remaining as a reserve for the colours.

The platoon-firing is such as must necessarily produce a general confusion, as well by the noise of those who command, as by the

breaking of the line, and kneeling, which are three of the greatest inconveniences that can happen; and it cannot be executed without imminent danger, when near the enemy. Even the king of Prussia himself is of the same opinion; for he says, "the platoon fire would, no doubt, be the best, if it could be executed."

FIRING advancing, is performed in the same manner as when standing, with this addition, that before either division or platoon fires, it advances 3 paces forwards; and so of the rest.

FIRING retreating, varies greatly from either of the former methods; for before either a division or platoon fires (supposing they are marching from the enemy) it must go to the right about, and after firing, to the left about again, and continue the retreat as slow and orderly as possible.

Hedge-FIRING, is only applicable when troops happen to be drawn up opposite to one another, and behind parallel fences, such as low walls, banks, hedges, &c. by the intervention of which they cannot approach nearer to each other. In this kind of firing, the men are to be drawn up 2 deep, which will of course either make their ranks more extensive, or will procure them a reserve; and in that order both ranks are to fire standing.

Parapet-FIRING, like hedge-firing, cannot be introduced conveniently at the time of common exercise. This arrangement is one of those operations which are only intended for defence; and the method requisite for that disposition depends as well upon the nature of the parapet over which the men are to fire, as upon that of the attack made to possess it. Hence, this method of firing is sometimes performed by single ranks stepping upon the banquette, and firing; each man instantly handing his arms to the centre rank of the same file, and taking his back in the room of it; and then he of the centre rank gives it to him in the rear to load, and takes back his in return, ready to give to him in the front rank; by which means the front-rank man can fire 6 or 7 rounds in a minute with exactness. Parapet-firing may also be executed 2 deep, in a fortification, where the banquette is 3 feet broad, or in field-works where no banquettes are made. In short, were those who are to defend, but to understand their own advantage, and to act with temper on every occasion, they would find themselves able to baffle almost any attack that should be made against them.

Oblique-FIRING, is either to the right and left, or from the right and left to the centre, depending entirely on the situation of the object to be fired against. The Prussians have a particular

sicular contrivance for this purpose: if they are to level to the right, the rear ranks of every platoon are to make two quick but small paces to the left, and the body of each soldier to turn 1-8th of a circle; and they are to take the same distance to the right, if they are to level to the left. Perhaps if one was to wheel out the divisions or platoons of a battalion 1-6th or 1-8th of a circle, it would render their fire direct, though the object be extremely oblique.

Street-FIRING, is made use of when two bodies of men meet in a street, road, defile, or any such like situation, where both are equally alike inclosed in such pass, and neither of them can attack the other's flank. In our present discipline we practise two methods of street-firing; the one is, by making the division or platoon that has fired, to wheel afterwards by half-rank to the right and left outwards from the centre, and to march in that order by half-divisions down the flanks on each side of the column, and to draw up in the rear, and go on with their priming and loading. The other method is, to make the division or platoon, after firing, to face to the right and left outwards from the centre, and one half-rank to follow the other; and in that order to march in one centre file down on each side of the column into the rear, and there draw up as before.

Now, by the first method, you must have a front double the extent of your rank, otherwise, the division that fires cannot wheel out, and march into the rear: consequently the enemy will have an advantage of a front double in extent to yours; which will enable him not only to return your attack with a front of equal force, but to attack you at the same time on each flank with a quarter force more, besides the further advantage he gets by the time you spend in wheeling to clear your front for the succeeding division to come up and fire.

And as to the other method, though you increase by the extent of your ranks, and consequently the weight of your fire; yet, what is thus gained in front, is more than lost in time, by the still more tedious form of making the ranks to face to the right and left outwards, and to follow each other into the rear, which gives an opportunity that a sagacious spirited enemy will not fail to improve, and take advantage of to your total destruction.

Instead of the above methods, we should prefer the column formed of ranks; because, at most, roads, streets, &c. are seldom of equal breadth in all parts. This column can, from its construction, easily contract itself by doubling its ranks, and again unfold

itself to its former breadth, as occasion requires, which operation a column of files cannot effect; and, instead of firing, only make use of the bayonet, and decide the affair by manly vigour. The advantages of this method are these: 1st, the enemy cannot get in upon either of your flanks, to disorder you; and, 2dly, as the enemy will be ignorant of your design to reserve your fire, and solely to depend upon your bayonet, he will most probably give his fire on your advancing, which as sure as he does, he is inevitably lost.

Square-FIRING, is that method of firing where either a regiment or any body of men are drawn up in a hollow square, each front of which is generally divided into 4 divisions or firings, and the flanks of the square, as being the weakest part, are covered by 4 platoons of grenadiers. The first fire is from the right division of each face; the second fire from the left division of each face, and so on; the grenadiers making the last fire.

Running-FIRE, when men, drawn up for that purpose, fire one after another, as fast as possible, so that it runs the whole length of the line, &c. It is used upon all public rejoicings.

FIRING by a new method proposed. Having ventured to mention our objections to the present methods of firing, we will now take the liberty to propose an entire new scheme of firing. As the grenadier company of every battalion is frequently detached from it, at least in its firings, we will therefore say that the battalion, with which we are going to perform this new method of firing, consists of 8 companies; and as we imagine that 4 good soldiers should keep up a quick and constant fire, so we conceive that 4 good divisions should do so; and thence propose, that the battalion shall fire at 4 times. However, for reasons given, we do not mean to fire by grand divisions, but to divide each of those grand divisions into 4 platoons; and that one platoon from each grand division shall fire at the same time, or as nearly so as may be practicable. Thus 4 platoons being equal to 1 grand division, would, in effect, fire at once, but from different parts of the battalion; and the whole battalion, divided into 16 platoons, would fire at 4 times: by which method a perpetual fire will be kept up, and managed with much more ease and regularity than the present method. The Swedes were the first who practised firing by 2 or 3 ranks at a time, and that so early as 1620. Platoon-firing is the invention of the famous Gustavus Adolphus, and first used about the year 1618: we also find that Lewis XIV, in 1662, employed M. Martinet to regulate and

and discipline his infantry after the Dutch manner, which was then in great esteem under prince Maurice, of Nassau, who had learned it from the king of Sweden.

FLAGS. See COLOURS, STANDARDS, &c.

FLANKS, in the *art of war and fortifications*, are of several denominations, according to their uses, viz.

FLANKS of an army, are the troops encamped on the right and left of each line of encampment.

FLANK of a bastion, in *fortification*, that part which joins the face to the curtain, comprehended between the angle of the curtain and that of the shoulder, and is the principal defence of the place. Its use is, to defend the curtain, the flank, and face of the opposite bastion, as well as the passage of the ditch; and to batter the salient angles of the counterscarp and glacis, from whence the besieged generally ruin the flanks with their artillery; for the flanks of a fortification are those parts which the besiegers endeavour most to ruin, in order to take away the defence of the face of the opposite bastion.

Oblique } FLANK, { that part of the curtain
Second } { from whence the face of
the opposite bastion may be discovered, and is
the distance between the lines rasant and fichant,
which are rejected by most engineers, as being
liable to be ruined at the beginning of a siege,
especially when made of sandy earth. The second
parapet, which may be raised behind the former,
is of no use; for it neither discovers nor
defends the face of the opposite bastion: besides,
it shortens the flank, which is the true defence;
and the continual fire of the besiegers cannon
will never suffer them to raise a second parapet.
This second flank defends very obliquely the
opposite face, and is to be used only in a place
attacked by an army without artillery.

Retired }
Low } FLANK, { the platform of the cazemate,
Covered } { which lies hid in the bastion. These
retired flanks are a great defence to the opposite
bastion and passage of the ditch; because the
besiegers cannot see, nor easily dismount their
guns.

FLANKED angle, in *fortification*, that formed by the 2 faces of a bastion, or its salient angle.

FLANKING angle, in *fortification*, that composed of the two lines of defence, and pointing towards the curtain. See TENAILLE.

FLANKING line of defence. See Line of defence.

FLANK prolonged, in *fortification*, is the extending of the flank from the angle of the epaule to the exterior side, when the angle of the flank is a right one.

To FLANK, in the *art of war*, is to discover and fire upon the side or flank of an enemy. Any fortification, which has no defence but right forward, is faulty; and to make it complete, one part ought to flank the other.

Concave FLANK, is that which is made in the arc of a circle.

FLANKING, is the same in *fortification* as defending.

FLANK, in *general*, is any part of a work that defends another work, along the outside of its parapet.

FLASK, in *ancient military history*, a measure made of horn, formerly used to carry powder in, with the measure of the charge of the piece on the top of it.

FLAT-bottomed boats, in *military affairs*, are made to swim in shallow water, and to carry a great number of troops, artillery, ammunition, &c. They are constructed in the following manner: a 12-pounder, bow chase, an 18 ditto, stern chase; 90 to 100 feet keel; 12 to 24 ditto beam; one mast; a large square mainsail; a jibb-sail: they are rowed by 18 or 20 oars, and can each carry 400 men. The gun takes up one bow, and a bridge the other, over which the troops are to march. Those that carry horses have the fore parts of the boats made to open, when they are to mount and ride over a bridge.

FLATTER-mine. See MINE.

FLECHE, in *field fortification*, a work of two faces, usually raised in the field, to cover the quarter guards of a camp or advanced posts.

FLINTS, in *military affairs*, are well known stones, used at present with all sorts of fire-arms. Every soldier ought always to have 1 or 2 spare flints in war-time.

FLYING - { army. See ARMY.
bridge. See BRIDGE.

FLYING-camp. See CAMP.

FOCUS, in *mining*. See MINE.

FODDER. See FORAGE.

FOIL, in *fencing*, a blunt sword, used to learn to fence with; it is without a point, or any sharpness, having a button at the extremity, covered with leather.

FOOT, in a *military sense*, signifies all those bodies of men that serve on foot. See INFANTRY.

Foot, is also a long measure, consisting of 12 inches. Geometricians divide the foot into 10 digits, and the digits into 10 lines; but we divide the foot into 12 inches, and an inch into 12 lines, and a line into 12 points.

A square FOOT, is the same measure, both in length and breadth, containing $12 \times 12 = 144$ square or superficial inches.

F O O

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A cubic Foot, is the same measure in all the 3 dimensions, length, breadth, and thickness; containing $12 \times 12 = 144 \times 12 = 1728$ cubic inches. The foot is of different length in different countries. The Paris royal foot exceeds the English by 9 lines; the ancient Roman foot of the capital, consisted of 4 palms $= 11\frac{1}{10}$ English inches; and the Rhineland or Leyden foot, by which the northern nations go, is to the Roman foot as 950 to 1000. The proportions of the principal feet of several nations are as follow. The English foot being divided into 1000 parts, or into 12 inches, the other feet will be as follow:

PLACES.	1000 parts	feet	inch.	lines
London foot	1000	—	12	—
Amsterdam	942	—	11	3
Antwerp	946	—	11	2
Bologna	1204	1	2	4
Berlin	1010	1	—	2
Bremen	964	—	11	6
Cologne	954	—	11	4
Copenhagen	965	—	11	6
Dantzic	944	—	11	3
Dort	1184	1	2	2
Frankfort on the main	948	—	11	4
The Greek	1007	1	—	1
Mantua	1569	1	6	8
Mechlin	999	—	11	—
Middlebourg	991	—	11	9
Paris Royal	1068	1	—	9
Prague	1026	1	—	3
Rhineland	1033	1	—	4
Riga	1831	1	9	9
Roman	967	—	11	6
Old Roman	970	—	11	8
Scotch	1005	1	—	$\frac{3}{7}$
Straßbourg	920	—	11	—
Madrid	899	—	10	7
Lisbon	1060	1	—	6
Turin	1062	1	—	7
Venice	1162	1	1	9

to be on the SAME FOOT with another, is to be under the same circumstances in point of service; to have the same number of men, and the same pay, &c.

To gain or lose ground FOOT by FOOT, is to do it regularly and resolutely; defending every thing to the utmost extremity, or forcing it by dint of art or labour.

Foot-bank, in fortification. See BANQUETTE.

FORAGE, in the art of war, implies hay, straw, and oats, for the subsistence of the army-horses. This forage is divided into rations,

one of which is a day's allowance for a horse, and contains 20lb. of hay, 10lb. of oats, and 5lb. of straw.

FOREIGN service, in military matters, means every service but our own.

FORELAND, in fortification. See BERM.

FORGE, in the train of artillery, is generally called a *travelling-forge*, and may not be improperly called a portable smith's shop: at this forge all manner of smith's work is made, and it can be used upon a march, as well as in camp. Formerly they were very ill contrived, with 2 wheels only, and wooden supporters to prop the forge for working when in the park. Of late years they are made with 4 wheels, which answers their purpose much better.

Dimensions of a travelling-FORGE.

	Inches.
Fore wheels, height	104
Nave, length	14
Diameters - - - { body	12
{ middle	13
{ linc	9
Fellies - - - { height	4
{ breadth	3
Spokes - - - { breadth	1.7
{ thickness	3
Hind wheels, height	64
Nave, length	14
Diameters - - - { body	12
{ middle	13
{ linc	9
Fellies - - - { height	4
{ breadth	3
Spokes - - - { breadth	1.7
{ thickness	3
Fore axle-tree, total length	76
Hind axle-tree, total length	76
Body - - - { length	42
{ breadth	6
{ height	7
Arms, length	17
Diameters - - { body	5
{ linc	3
Shafts with sides, total length	20.3
Breadth - - { behind	4
{ middle	4.5
{ before	2.8
Height - - { behind	3
{ before	2
{ middle	2.8
Opening - - { before	25
{ middle	35
{ behind	30
Naves - - { length	14
{ breadth	3
{ height	6

*Uprights

F O R

Uprights	-	{	length	27
			breadth	3
			thickness	2.2
Fore cross-bar	-	{	breadth	3
			thickness	2.2
Hind cross-bar		{	breadth	2
			thickness	2.2
From the fore end to the axle-tree				23
From the hind end to the axle-tree				14
Distance between				74

FORGE for red-hot balls, is a place where the balls are made red-hot before they are fired off: it is built about 5 or 6 feet below the surface of the ground, of strong brick-work, and an iron grate, upon which the balls are laid, with a very large fire under them. See **RED-HOT BALLS**.

FORLORN-hope, in the *military art*, signifies men detached from several regiments, or otherwise appointed to make the first attack in the day of battle; or at a siege, to storm the counterscarp, mount the breach, &c. They are so called from the great danger they are unavoidably exposed to; but the expression is old, and begins to be obsolete.

FORMS, } in *gunnery*, are round pieces

FORMERS, } of wood, fitted to the bore of every gun's diameter, on which the paper, parchment or flannel, which is to make the cartridges, are rolled before they are pasted or sewed.

FORMING the line, in the *military art*, drawing up infantry, cavalry, and artillery, into a line of battle, &c.

FORRAGE. See **FORAGE**.

FORT, in the *military art*, a small fortified place, environed on all sides with a ditch, rampart, and parapet. Its use is to secure some high ground, or the passage of a river, or to make good an advantageous post, to defend the lines and quarters of a siege, &c.

Forts are made of different figures and extents, according as the ground requires, or the service intended. Some are fortified with bastions, others with demi-bastions. Some are in form of a square, others of a pentagon. Some again are made in the form of a star, having 5 or 7 angles. A fort differs from a citadel, as this last is built to command some town. See **CITADEL**.

Royal-FORT, one whose line of defence is at least 26 toises long.

To fortify a square FORT, according to the usual method. Having inscribed the square in a circle (Plate X. fig. 1.) 1. Divide each of its sides AB , BD , &c. into two equal parts, in the point F . 2. From the centre E , draw an indefinite line EF . 3. From the centre draw also the lines EA , EB , ED , EC , to the angles

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of the square. 4. Divide the side AB into eight equal parts. 5. Let one of these parts be set off from F to G , and from G draw the lines of defence AG , BG . 6. Divide another side of the square into 7 equal parts. 7. Set off two of these parts from A to K , and from B to L , which will be the faces of the bastions. 8. Take the distance KL in your compasses, and set it off on the lines of defence from K to H , and from L to I ; and draw HI , which will be the curtain; and the lines KI , LI , will be the flanks.

To fortify a square fort in the most modern manner. Give the side AA (Plate X. fig. 3.) 130 fathoms; the demi-gorges AB , 25 fathoms; and with the compasses opened to the length of the pricked line BCB , which is the diagonal of two sides, from each of which there has been taken 25 fathoms, upon the extremity opposed to the angle which they form, describe two arches above the angle of the figure, alternatively making use of the points B for centres; then draw lines from the points of intersection of the arches D , to the point which served for centres B , upon which points B , raise the flanks BE , perpendicular to the opposed lines of defence BD .

Star-FORT, a redout formed by a number of re-entering, and salient angles, the sides of which flank each other. See Plate X. fig. 2.

To describe a star-fort. 1. Draw an hexagon $ABCDEF$. 2. Divide one of its sides BC into 4 equal parts. 3. Upon the centre of this side, raise the perpendicular DA , equal to 1-4th of the side BC , from D to A . 4. From the point A , draw the faces AC , AB . Let the same operations be performed with respect to the other sides of the hexagon, and you will have the star-fort required.

Triangular FORTS, are frequently made with half-bastions; but very imperfect, because the faces are not seen or defended from any other part. If, instead of being terminated at the angle, they were directed to a point about 20 toises from it, they would be much better, as being then defended by that length of the rampart, though but very obliquely. The ditch ought to be from 8 to 10 toises. See Plate X. fig. 4. Sometimes they are made as in Plate X. fig. 5. that is, triangular as before; but instead of half-bastions at the angles, whole ones are placed in the middle of the sides. The gorges of these bastions may be from 20 to 24 toises, when the sides are from 100 to 120; the flanks are perpendicular to the sides, from 10 to 12 toises long; and the capitals from 20 to 24. If the sides happen to be more or less, the parts of the bastions.

bastions are likewise made more or less in proportion. The ditch round this fort may be 10 or 12 toises wide.

The ramparts and parapets of these sorts of works are commonly made of turf, and the outside of the parapet fraised; that is, a row of pallisades are placed about the middle of the slope, in an horizontal manner, the points declining rather a little downwards, that the grenades or fireworks thrown upon them may roll down into the ditch; and if the ditch is dry, a row of pallisades should be placed in the middle of it, to prevent the enemy from passing over it unperceived, and to secure the fort from any surprise.

FORTIFICATION, in the *military art*, is the art of fortifying a town, or other place; or of putting it in such a posture of defence, that every one of its parts defends, and is defended by some other parts, by means of ramparts, parapets, ditches, and other outworks; to the end that a small number of men within may be able to defend themselves for a considerable time against the assaults of a numerous army without; so that the enemy, in attacking them, must of necessity suffer great loss. See Plate XI. fig. 1.

Fortification may be divided into ancient and modern; offensive, and defensive; regular, and irregular; natural, and artificial, &c.

Ancient **FORTIFICATION**, at first, consisted of walls or defences made of trunks, and other branches of trees, mixed with earth, for security against the attacks of an enemy. Invention owes its original to necessity; *fortification* seems to have had fear for its father; for when man had no other enemy but the wild beasts, the walls of his cottage were his security; but when pride, ambition, and avarice, had possessed the minds of the strong and the daring to commit violences upon their weaker neighbours, either to subject them to new laws, or to spoil their little inheritance, it was natural for the latter to contrive how to defend themselves from such injuries.

Whoever has been in North-America, may have seen *fortification* in its infancy.

There are abundance of Indian villages fenced round by long stakes drove into the ground, with moss or earth to fill the intervals; and this is their security (together with their own vigilance) against the cruelty of their savage neighbouring nations.

Nor is *fortification* much less ancient than mankind; for Cain, the son of Adam, built a city with a wall round it upon mount Liban, and called it after the name of his son Enoch, the ruins of which, it is said, are to be seen to

this day; and the Babylonians, soon after the deluge, built cities and encompassed them with strong walls.

At first people thought themselves safe enough with a single wall, behind which they made use of their darts and arrows with safety; but as other warlike instruments were continually invented to destroy these feeble structures, so on the other hand the defendants were obliged to build stronger and stronger, to resist the new contrived forces of the desperate assailers.

What improvements they made in strengthening their walls many ages ago, appear from history. The first walls we ever read of, and which were built by Cain, were of brick; and the ancient Grecians, long before Rome was ever thought of, used brick and rubble-stone, with which they built a vast wall, joining mount Hymetus to the city of Athens. The Babylonian walls, built by Semiramis, or, as others will have it, by Belus, were 32 feet thick, and 100 feet high, with towers 10 feet higher, built upon them, cemented with bitumen or asphaltus. Those of Jerusalem seem to have come but little short of them, since, in the siege by Titus, all the Roman battering-rams, joined with Roman art and courage, could remove but 4 stones out of the tower of Antonia in a whole night's assault.

When *fortification* was at this height, it stopped for many ages, 'till the use of gunpowder and guns was found out; and then the round and square towers, which were very good flanks against bows and arrows, became but indifferent ones against the violence of cannon; nor were the battlements longer a hiding-place, when the force of one shot both overset the battlement, and destroyed those who sought their security from it.

Modern **FORTIFICATION**, is the way of defence now used, turning the walls into ramparts, and square and round towers into bastions, defended by numerous outworks; all which are made so solid, that they cannot be beat down, but by the continual fire of several batteries of cannon. These bastions at first were but small, their gorges narrow, their flanks and faces short, and at a great distance from each other, as are those now to be seen in the city of Antwerp, built in 1540 by Charles V. emperor of Germany; since which time they have been greatly improved and enlarged, and are now arrived to that degree of strength, that it is almost a received opinion, that the art of fortification is at its height, and almost incapable of being carried to a much greater perfection. See Plate XI. fig. 1.

F O R

Offensive FORTIFICATION, shews how to besiege and take a fortified place; it further teaches a general how to take all advantages for his troops; the manner of encamping, and method of carrying on either a regular or irregular siege, according as circumstances may direct.

Defensive FORTIFICATION, shews a governor how to make the best of a garrison committed to his care, and to provide all things necessary for its defence.

Regular FORTIFICATION, is that built in a regular polygon, the sides and angles of which are all equal, being commonly a musket-shot from each other, and fortified according to the rules of art.

Irregular FORTIFICATION, on the contrary, is that where the sides and angles are not uniform, equi-distant, or equal; which is owing to the irregularity of the ground, vallies, rivers, hills, and the like.

To FORTIFY inwards, is to represent the bastion within the polygon proposed to be fortified; and then that polygon is called the *exterior polygon*, and each of its sides the *exterior side*, terminating at the points of the two nearest bastions.

To FORTIFY outwards, is to represent the bastion without the polygon proposed to be fortified, and then the polygon is called the *interior polygon*, and each of its sides the *interior side*, terminating in the centres of the two nearest bastions.

Elementary FORTIFICATION, by some likewise called the theory of fortification, consists in tracing the plans and profiles of a fortification on paper, with scales and compasses; and examining the systems proposed by different authors, in order to discover their advantages and disadvantages. The elementary part is likewise divided into regular and irregular fortification, which see.

Practical FORTIFICATION, consists in forming a project of a fortification, according to the nature of the ground, and other necessary circumstances, to trace it on the ground, and to execute the project, together with all the military buildings, such as magazines, store-houses, barracks, bridges, &c.

The names of every part of a FORTIFICATION, and first of lines, which are divided into right lines, and curve lines.

Line of defence, is the distance between the salient angle of the bastion, and the opposite flank; that is, it is the face produced to the flank. Common experience, together with some of the greatest artists in fortification, unanimously agree, that the *lines of defence* may extend (though

not exceed) 150 fathom. Some indeed will affirm that, a musket carrying no more than 130 fathom point-blank, the angle of the bastion should be no further removed from its opposite flank. I agree that a musket carries no farther point-blank; but I am sure it will do execution, and kill, at 180 fathom. The enemy generally make their breaches near the middle of the face; which if granted, the line of fire from the flank to the breach, scarce exceeds 130 fathom; besides, the cannon of the flank do less execution upon a *short line of defence* than on a long one.

Line of defence sabbant, is a line drawn from the angle of the curtain, to the point of the opposite bastion, which is not to exceed 120 fathom; and from the point of the curtain, and flank, the face of the opposite bastion is to be defended. This line may not improperly be called in good English the *butting-flank*, since it partly sees the opposite faces in reverse; and the shot from it, especially near the orillon, strike against the faces. The authors are numerous both for and against the *sabbant* and *razant* lines; thence we shall only add, that the more powerful the active quality is, the more the passive must suffer; that in fortification the active quality is the fire, which discovers the assailants (who are the passive) going to attack the face of the opposite bastion; and by consequence, the more this active quality is augmented, by so much more the passive subjects must suffer: and from thence we argue for the *sabbant flank*, since it augments this active quality, by all the fire of the curtain added to the flank, which is the principal action in the art of defence.

Line of defence razant, is a line drawn from the point of the bastion along the face, till it comes to the curtain, which shews how much of the curtain will clear or defend the face. This line may very justly in our language be called the *sweeping-flank*; because the shot as it were sweeps along the opposite faces. This line, as well as the *sabbant*, has many defendants, and as many opponents; thence, we will only observe, that in our humble opinions the *line sabbant* is preferable to the *line razant*.

Line of circumvallation. See SIEGE. See CIRCUMVALLATION.

Line of countervallation. See SIEGE. See COUNTERVALLATION.

Line of counter-approach. See SIEGE. See APPROACHES.

Capital-line, is an imaginary line which divides the work into two equal and similar parts, or a line drawn from the point of the bastion to the point where the two demi-gorges meet, &c.

Line

Line of defence prolonged. In the square, and most polygons of the lesser fortification, you prolong the line of defence; but in the polygons of the greater and meaner, you draw a line from the angle of the opposite shoulder to the angle of the curtain, upon which you raise a perpendicular, which serves for the first line of the flank.

Names of the angles in a FORTIFICATION.

Angle of the centre, in a polygon, is formed by two radii drawn to the extremities of the same side, or from the centre, terminating at the two nearest angles of the figure.

Angle of a bastion, } that which is made by the
Flanked angle, } two faces, being the utmost part of the bastion, most exposed to the enemy's batteries, frequently called the salient angle, or point of the bastion.

Angle of the polygon, is made by the concurrence of 2 adjacent sides of a polygon, in the centre of the bastion.

Angle of the { *triangle,* is half the angle of the polygon.
 { *shoulder,* } is made by the face
 { *epaule,* } and flank of the bastion.
flank, } that which is made by,
curtain, } and contained between the curtain and the flank.

Angle of the tenaille, } made by 2 lines fichant,
Flanking-angle, } that is, the faces of the 2 bastions extended 'till they meet in an angle towards the curtain, and is that which always carries its point towards the work.

Dead-angle. } All angles are so called, that
Rentrant-angle. } point inwards, or are not well defended.

Angle of the ditch, is formed before the centre of the curtain, by the outward line of the ditch.

Re-entering angle, is any angle whose point turns inwards, or towards the place; that is, whose legs open towards the field.

Salient angle, is that which points outwards, or whose legs open towards the place.

Angle of the complement of the line of defence, is the angle formed by the intersection of the 2 complements with each other.

Inward flanking angle, that which is made by the flanking-line, and the curtain. See ANGLE.

Names of the solid works of a FORTIFICATION.

Area, the superficial content of a rampart, or other work.

Arrow, is a work placed at the salient an-

gle of the glacis, and consists of 2 parapets, each about 40 fathom long: this work has a communication with the covert-way, of about 24 or 28 feet broad, called a caponier, with a ditch before it of about 5 or 6 fathom, and a traverse at the entrance, of 3 fathom thick, and a passage of 6 or 8 feet round it.

Appareille, is that slope or easy ascent leading to the platform of the bastion, or to any other work where the artillery, &c. are brought up and down.

Advance-foss, } or ditch made at the foot of
Avant-fosse, } the glacis: it is but very seldom made, because it is easily taken, and serves for a trench to the besiegers.

Banquette, whether single or double, is a kind of step made on the rampart of a work near the parapet, for the troops to stand upon, in order to fire over the parapet: it is generally 3 feet high when double, and $1\frac{1}{2}$ when single, and about 3 feet broad, and $4\frac{1}{2}$ feet lower than the parapet.

Berm, is a little space, or path, of 6 or 8 feet broad, between the ditch and the talus of the parapet; it is to prevent the earth from rolling into the ditch, and serves likewise to pass and repass. As it is in some degree advantageous to the enemy, in getting footing, most of the modern engineers reject it.

Bastion, is a part of the inner inclosure of a fortification, making an angle towards the field, and consists of 2 faces, 2 flanks, and an opening towards the centre of the place, called the gorge: or it is rather a large mass of earth, usually faced with sods, sometimes with brick, but rarely with stone.

With regard to the first invention of bastions, there are many opinions amongst authors. Some have attributed this invention to Zisca, the Bohemian; others to Achmet Bashaw, who having taken Otranto in the year 1480, fortified it in a particular manner, which is supposed to be the first instance of the use of bastions. Those who wrote on the subject of fortification 200 years ago, seem to suppose, that bastions were a gradual improvement in the ancient method of building, rather than a new thought, that any one person could claim the honour of. Be as it will, they were well known soon after the year 1500. For in 1546, Tartalea published his *Questi & inventioni diverse*, in the 6th book of which he mentions, that whilst he resided at Verona (which must have been many years before) he saw bastions of a prodigious size; some finished, and others building: and there is besides, in the same book, a plan of Turin, which was then fortified with 4 bastions, and seems to have been completed some time before.

The great rule in constructing a bastion is, that every part of it may be seen and defended from some other part: mere angles are therefore not sufficient; but flanks and faces are necessary. The faces must not be less than 50 fathom, nor more than 65. The flanks are so much the better the longer they are, and must therefore stand at right angles with the line of defence. At the same time the disposition of the flanks makes the principal part of a fortification, as on them the defence chiefly depends; and it is this that has introduced the various kinds of fortifying.

The angle of the bastion must exceed 60° ; otherwise it will be too small to give room for the guns, and will either render the line of defence too long, or the flanks too short. It must therefore be either a right angle, or some intermediate one between that and 60 degrees.

Gorge of a bastion, the interval between the extremity of one flank and that of the next.

Solid bastion. } A bastion is said to be solid or
Full bastion. } full, when the level ground within is even with the rampart; that is, when the inside is quite level, the parapet being only more elevated than the rest. They have this advantage over others, that they afford earth enough to make a retrenchment, in case the enemy lodge themselves on the top of the bastion, and the besieged are resolved to dispute every inch of ground.

Hollow bastion, } is that where the level ground
Empty bastion, } within is much lower than the rampart, or that part next to the parapet, where the troops are placed to defend the bastion. The disadvantage of these kinds of bastions is, the earth being so low, that when an enemy is once lodged on the rampart, there is no making a retrenchment towards the centre, but what will be under the fire of the besiegers.

Detached bastion, is that which is separated or cut off from the body of the place, and differs from a half-moon, whose rampart and parapet are lower, and not so thick as those of the place, having the same proportion with the works of the place. Counter-guards with flanks are sometimes called detached bastions.

Cut bastion, is that whose salient angle or point is cut off, instead of which it has a re-entering angle, or an angle inwards, with 2 points outwards; and is used either when the angle would, without such a contrivance, be too acute, or when water, or some other impediment, prevents the bastion from being carried to its full extent.

Composed bastion, is when 2 sides of the in-

terior polygon are very unequal, which also renders the gorges unequal: it may not improperly be called a *forced bastion*, being as it were forced into that form.

Deformed bastion, is when the irregularity of the lines and angles causes the bastion to appear deformed, or out of shape.

Demi-bastion, is composed of one face only, has but one flank, and a demi-gorge.

Double bastion, is that which is raised on the plane of another bastion, but much higher; leaving 12 or 18 feet between the parapet of the lower, and the foot of the higher; and is sometimes in the nature of a cavalier.

Regular bastion, is that which has its true proportion of faces, flanks, and gorges.

Irregular bastion, is that wherein the above equality of just proportion is omitted.

Barriers, in fortification, a kind of rails to stop the horse or foot from rushing in upon the besieged with violence.

Bonnet, in fortification, is a sort of work placed before the salient angle of the ravelin to cover it: it consists of 2 faces, parallel to the ravelin, or perpendicular to those of the lunette. They are generally made 10 fathom broad at the ends, with a ditch of the same breadth, the covert-way 6, and the glacis 20 fathom.

Breach, in fortification, is an opening or gap made in a wall or rampart, with either cannon or mines, sufficiently wide for a body of troops to enter the works, and drive the besieged out of it.

Practical breach, is that where men may mount, and make a lodgement, and should be 15 or 20 feet wide.

Caponier, is a passage made from one work to another, of about 10 or 12 feet wide, covered on each side by a parapet, terminating in a slope or glacis.

Cascaes, in fortification, a kind of cellars made under the capital of a fortification; also subterraneous passages or galleries to discover the enemy's mines.

Casemate, in fortification, is a work made under the rampart, like a cellar or cave, with loop-holes to place guns in it.

Cavalier, in fortification, is a work raised generally within the body of the place, 10 or 12 feet higher than the rest of the works. Their most common situation is within the bastion, and they are made much in the same form: they are sometimes placed in their gorges, or on the middle of the curtain, and then are in the form of a horse-shoe, only flatter.

The use of cavaliers is, to command all the adjacent works and country round them: they are seldom.

seldom or never made but when there is a hill or rising ground which overlooks some of the works.

Coffers. See COFFERS.

Covert-way, in *fortification*, is a space of 6 fathom broad, going quite round the works, and is adjoined to the counterscarp of the ditches, covered by a parapet $7\frac{1}{2}$ feet high, including a banquette of $2\frac{1}{2}$ feet, terminating in an easy slope towards the field, at a distance of 18 or 20 fathom.

Sometimes the covert-way is sunk 2 or 3 feet below the horizon of the field; for, as such works are never made to discover the enemy in their trenches, so this method of lowering the covert-way will give room for the fire of the lower curtain (in works that have one) to scour the esplanade; and the expence of it should be the most material objection against it.

Counter-guard, in *fortification*, is a work placed before the bastions to cover the opposite flanks from being seen from the covert-way; they are likewise made before the ravelins.

When counter-guards are placed before the bastions, they are esteemed of very great use. They were first invented by Pasino, in 1579, and greatly improved by Speckle, in 1589.

Counterscarp, in *fortification*, is properly the exterior talus of the ditch, or the further side from the body of the place, and facing it.

Crown-work, in *fortification*, is a kind of work not unlike a crown: it has 2 fronts and 2 branches. The fronts are composed of 2 half-bastions and 1 whole one: they are made before the curtain or the bastion, and generally serve to inclose some buildings which cannot be brought within the body of the place, or to cover the town-gates, or else to occupy a spot of ground which might be advantageous to an enemy. They are of such an expence, that they are rarely found in practice. The best use this work can possibly be put to, is to cover 2 joining curtains, when the sides of it will be parallel to the sides of the place, and it should be fortified with the same strength, and in the same manner.

The authors who have written on this work, have never thought of this useful part; and we often see 2 horn-works put in practice to cover 2 curtains, where the crown-work would do it much cheaper and much better.

Cordon, in *fortification*, is a round projection made of stone, in a semi-circular form, whose diameter is about 8 inches, and goes quite round the wall, and within 4 feet from the upper part.

Curtain, in *fortification*, is that part of the body of the place, which joins the flank of one

bastion to that of another. The strait curtains have always been preferred to the different designs which have been proposed, of which some have diminished the expence, and (at the same time) the strength of the place: others have somewhat augmented the strength, but greatly diminished its area.

Counter-forts, in *fortification*, are by some called *buttresses*: they are solids of masonry, built behind walls, and joined to them at 18 feet distance from centre to centre, in order to strengthen them, especially when they sustain a rampart or terras.

Cuvette, } in *fortification*, is a small ditch of
(*unette*, } 10 or 12 feet broad, made in the middle of a large dry ditch, serving as a retrenchment to defend the same, or otherwise to let water into it, when it can be had in the time of a siege.

Demi-lune. See RAVELIN.

Detached bastion. See BASTION.

Detached redout. See REDOUT.

Ditch, in *fortification*, is a large deep trench made round each work, generally from 12 to 22 fathom broad, and from 15 to 16 feet deep: the earth dug out of it serves to raise the rampart and parapet. Almost every engineer has a particular depth and breadth for ditches; some are for narrow ones and deep, others for broad ones and shallow; and it is most certain that ditches should be regulated according to the situation. In regard to wet or dry ditches, almost all authors have given it in favour of the latter; and we shall only add, that the best of all are those which can either be filled or kept dry at pleasure.

Embrasures. See BATTERY.

Epaulement. See SIEGE.

Exterior side of a fortification, is the distance or imaginary line drawn from one point of the bastion to that of the next.

Faces of the bastion. See BASTION.

Faces, of any work, in *fortification*, are those parts where the rampart is made, making an angle pointing outwards.

Fascine. See BATTERY. See SIEGE.

Fausse-bray, in *fortification*, is a low rampart going quite round the body of the place; its height is about 3 feet above the level ground, and its parapet is about 3 or 4 fathom distant from that of the body of the place. These works are made at a very great expence: their faces are very easily enfiladed, and by consequence their flank seen in reverse: the enemy is under cover the minute he becomes master of them; and a great quantity of shells which may be thrown into them, and must of necessity lodge there, will

will go near to make a breach in them, or at worst to drive every one out. Hence they are liable to do more harm than good, and contribute no way to the defence of the place. Mr. Vauban, only makes them before the curtains, and as such calls them *tenailles*.

Flanks, in fortification, in general, are any parts of a work, which defend another work along the outsides of its parapets.

Flanks of the bastion, are the part between the face and curtain: the flank of one bastion serves to defend the ditch before the curtain and face of the opposite bastion.

Flanking is the same thing, in *fortification*, as defending.

Retired flanks, are those made behind the line which joins the extremity of the face and the curtain, towards the capital of the bastion.

Concave flanks, are those which are made in the arc of a circle.

Direct or grazing flank, is that which is perpendicular to the opposite face produced, and oblique or *sichant*, when it makes an acute angle with that face.

Second flank. When the face of a bastion produced does not meet the curtain at its extremity, but in some other point; then the part of the curtain between that point and the flank, is called the second flank. The modern engineers have rejected this method of fortifying. See *FLANK*.

Fleche, a work of 2 faces, often constructed before the glacis of a fortified place, when threatened with a siege, in order to keep the enemy as long at a distance as possible.

Genouilliers, the undermost part of a battery, or the part from the platform to the embrasures.

Glacis, in fortification, is the part beyond the covert-way, to which it serves as a parapet, and terminates towards the field in an easy slope at about 20 fathom distance. Sometimes double glacis are made parallel to the esplanade, and at the distance of 16 or 20 fathoms. Some authors think these works never answer the expence; however, M. Vauban was so sensible of their goodness, that he never failed to make them when he found the ground convenient for it; because, when such works are defended by a skilful governor, they will make a noble defence.

Gorge, of a bastion, is the interval between the extremity of one flank and that of the other.

Gorge, of any work, is that part next to the body of the place, where there is no rampart or parapet; that is, at the counterscarp of the ditch.

Hornwork, in fortification, is composed of a

front and 2 branches: the front is made into 2 half-bastions and a curtain: this work is of the nature of a crown-work, only smaller, and serves for the same purposes. The use of horn-works in general is to take possession of some rising ground advanced from the fortification; the distance of which determines that of the horn-work; and they are placed either before the curtain, or before the bastions, according to circumstances.

Horse-shoe, is a small round or oval work, with a parapet, generally made in a ditch, or in a marsh.

Half-moon. See *RAVELIN*.

Lodgements. See *SIEGE*.

Loop-holes, in fortification, are either square or oblong holes, made in the wall, to fire through with muskets.

Lunettes, in fortification, are works made on both sides of a ravelin: one of their faces is perpendicular to half or $\frac{1}{3}$ ds of the faces of the ravelin, and the other nearly so to those of the bastions.

There are likewise lunettes, whose faces are drawn perpendicular to those of the ravelin, within $\frac{1}{3}$ d part from the salient angle; whose semi-gorges are only 20 fathoms.

These kinds of works make a good defence, and are of no great expence; for as they are so near the ravelin, the communication with it is very easy, and one cannot well be maintained 'till they are all three taken.

Lunettes, are also works made beyond the second ditch, opposite to the places of arms: they differ from the ravelins only in their situation.

Lunettons, are small lunettes.

Merlon, in fortification, that part of the breast-work of a battery, which is between the embrasures.

Orillon, in fortification, is a part of the bastion near the shoulder, which serves to cover the retired flank from being seen obliquely: it is sometimes faced with stone, on the shoulder of a crenellated bastion, to cover the cannon of the retired flank, and hinder them from being dismounted by the enemy's cannon.

Of all the works in a fortification, there is none more capable to defend the passage of the ditch, and to destroy the miner, wheresoever he enters himself, than the orillon. Experience in the last war has shewn us of what vast advantage it is to have 2 or 3 reserve pieces of cannon, which command the ditch, and the face of the opposite bastion, in such a manner as to destroy the attempts of the miners, and see the breach in reverse. Hence the great advantages of a double flank thus concealed, weigh so very much

with us, and convince us so entirely of their usefulness, that we affirm no place to be well fortified without the orillon, and that the strait flank is fit for nothing but field-works.

The orillon is as old as the bastion, and was first made use of about the year 1480; and we find them frequent in the works of Pasino and Speckle, first published in 1579 and 1589.

Out-works. See WORKS.

Pallisades, in *fortification*, are a kind of stakes made of strong split wood of about 9 feet long, fixed 3 feet deep in the ground, in rows about 6 inches asunder: they are placed in the covert-way, at 3 feet from, and parallel to the parapet of the glacis, to secure it from being surprised.

Parapet, in *fortification*, is a part of the rampart of a work, of 18 or 20 feet broad, and raised 6 or 7 feet above the rest of the rampart: it serves to cover the troops placed there to defend the work against the fire of the enemy.

Parallels. See SIEGE.

Port-cullice, in *fortification*, is a falling gate or door, like a harrow, hung over the gates of fortified places, and let down to keep out the enemy.

Place of arms, in *fortification*, is a part of the covert-way, opposite to the re-entering angle of the counterescarp, projecting outward in an angle. They are generally 20 fathoms from the re-entering angle of the ditch on both sides, and the faces are found by describing a radius of 25 fathoms.

Places of arms. See SIEGE.

Pits or ponds, in *fortification*, are little holes dug between the higher and lower curtains, to hold water, in order to prevent the passing from the tenailles to the flanks.

Profiles, in *fortification*, are representations of the vertical sections of a work; and serve to shew those dimensions which cannot be represented in plans, and are yet necessary in the building of a fortification: they may be very well executed and constructed upon a scale of 30 feet to an inch. By a profile are expressed the several heights, widths, and thicknesses, such as they would appear were the works cut down perpendicularly from the top to the bottom.

Rampart, in *fortification*, is an elevation of earth raised along the faces of any work, of 10 or 15 feet high, to cover the inner part of that work against the fire of an enemy: their breadths differ according to the several systems; for De Ville makes them 12½ fathoms, M. Vauban 6, and others 10 fathoms.

Rams-horns, in *fortification*, are a kind of low work made in the ditch, of a circular arc: they were first invented by Mr. Belidor, and serve instead of tenailles.

Ravelin, in *fortification*, is a work placed before the curtain to cover it, and prevent the flanks from being discovered sideways: it consists of 2 faces meeting in an outward angle. Some ravelins are counterguarded, which renders them as serviceable as either the cunettes or tenaillons.

Redans, in *fortification*, are a sort of indented works, consisting of lines or faces that form sallying or re-entering angles, flanking one another, and are generally used on the sides of a river running through a garrisoned town. They were used before bastions. Sometimes the parapet of the covert-way is carried on in this manner.

Redout, in *fortification*, is a kind of work placed beyond the glacis, and is of various forms. Their parapets, not being to resist cannon, are only 8 or 9 feet thick, with 2 or 3 banquettes. The length of their sides may be from 10 to 20 fathoms.

Redout, is also the name of a small work, made sometimes in a bastion, and sometimes in a ravelin, of the same form.

Redout, is likewise a square work without any bastions, placed at some distance from a fortification, to guard a pass, or to prevent an enemy from approaching that way.

Detached redout, is a kind of work much like a ravelin, with flanks placed beyond the glacis: they are made to occupy some spot of ground which might be advantageous to the besiegers; likewise to oblige the enemy to open their trenches farther off than they would do otherwise. Their distance from the covert-way should not exceed 120 toises, that it may be defended by musket-shot from thence.

Redouts-en-cremaillere, so called from their figure resembling a pot-hook, the inside line of the parapet being broken in such a manner, as to resemble the teeth of a saw; whereby this advantage is gained, that a greater fire can be brought to bear upon the défilé, than if only a simple face was opposed to it, and consequently the passage is rendered more difficult.

Revetement, in *fortification*, is a strong wall built on the outside of the rampart and parapet, to support the earth, and prevent its rolling into the ditch. When the revetement of a rampart goes quite up to the top, 4 feet of the upper part is a vertical wall of 3 feet thick, with a square stone at the top of it, projecting about 5 or 6 inches, and a circular one below, or where the slope begins, of 8 or 10 inches diameter. They go quite round the rampart, and the circular projection is called the *cordon*.

Retrenchment, in *fortification*, is any work raised to cover a post, and fortify it against an enemy,

enemy, such as fascines loaded with earth, gabions, sand-bags, &c.

Retrenchment. See SIEGE.

Rideau, in *fortification*, is a small elevation of earth, extending lengthways on a plane, and serving to cover a camp, or to give an advantage to a post. They are also convenient for the besiegers of a place, as they serve to secure the workmen in their approaches to the foot of a fortress.

Rideau, is also used sometimes for a trench, the earth of which is thrown up on its sides, to serve as a parapet for covering the men.

Sap. See SIEGE.

Sillon, in *fortification*, a work raised in the middle of a ditch to defend it when too broad. This work has no particular form, but as it runs, forms little bastions, half-moons, and redans, which are lower than the rampart of the place, but higher than the covert-way. It is not much used at present.

Talus, in *fortification*, are slopes made both on the outside and inside of every work, to prevent the earth's rolling down; and are of various denominations, viz.

Talus of the banquette, is that gentle slope from the top of the banquette to the horizontal line.

Interior talus of the parapet, the slope from the top of the parapet to the banquette.

Talus of the top of the parapet, that slope which lessens the height of the parapet towards the berm, by which means the troops firing from the banquette can defend the covert-way.

Exterior talus of the parapet, the slope of the parapet from the top to the berm.

Interior talus of the ditch, the slope from the top of the ditch to the bottom, within.

Exterior talus of the ditch, is the slope from the top of the ditch to the bottom, without.

Traverse, in *fortification*, is a parapet made cross the covert-way, opposite to the salient angles of the works, and near the places of arms, to prevent enfilades; they are 18 or 20 feet thick, and as high as the ridge of the glacis. There are also traverses made in the caponiers, but then they are called *tambours*.

Traverses, are likewise made within other works, when there are any hills or rising grounds which may see the insides of these works. Traverses that are made to cover the entrances of redouts in the field, need not be above 8 or 10 feet thick.

Tenailles, in *fortification*, are low works made in the ditch before the curtains; of which there are 3 sorts. The first are the faces of the

bastions produced 'till they meet, but much lower; the second have faces, flanks, and a curtain; and the third have only faces and flanks. Their height is about 2 or 3 feet higher than the level ground of the ravelin. Their use is to defend the bottom of the ditch by a grazing fire, as likewise the level ground of the ravelin, and especially the ditch before the redout within the ravelin, which can be defended from no where else so well as from them.

Tenailions, in *fortification*, are works made on each side of the ravelin, much like the lunettes; and only differ, in that one of the faces in a tenailion is in the direction of the face of the ravelin; whereas that of the lunette is perpendicular to it.

Tower-bastions, in *fortification*, are small towers made in the form of bastions; first invented by Mr. Vauban, and used in his second and third method; with rooms or cellars underneath, to place men and artillery in them. As these towers are almost a solid piece of masonry, they must be of great expence, though their resistance can be but little; for it has been found by experience, that the casemates are but of little use, because as soon as they have fired once or twice, the smoke will oblige the defenders to leave them, notwithstanding the smoke-holes: hence it may be concluded that the strength of these tower-bastions does by no means answer their expences; and that, if small bastions were made instead of them, without casemates, they would be much better, and of less expence.

Terre-pleine, in *fortification*, the horizontal superficies of the rampart, between the interior talus and the banquette.

Traditore, in *fortification*, signifies the concealed or hidden guns in a fortification, behind the reverse of the orillon.

Trous-de-loup, in *fortification*, round holes made about 5 or 6 feet deep, with a stake in the middle: they are generally dug round a field redout, to obstruct the enemy's approach; circular at top, and about 4½ feet diameter; pointed at the bottom like an inverted cone. Two or three rows of them are dug chequerwise, about 6 paces from the edge of the ditch, viz. two rows of holes exactly opposite to each other, and a third row in the middle, covering the intervals.

Zic-Zac. See SIEGE.

The principal maxim of fortification, are these, viz. 1. That every part of the works be seen and defended by other parts, so that the enemy can lodge no where without being exposed to the fire of the place.

FOR

FOR

2. A fortress should command all places round it; and therefore all the outworks should be lower than the body of the place.

3. The works farthest from the centre should always be open to those that are nearer.

4. The defence of every part should always be within the reach of musket-shot, that is, from 120 to 150 fathoms, so as to be defended both by great and small fire-arms; for if it be only defended by cannon, the enemy may dismount them by the superiority of their's, and then the defence will be destroyed at once; whereas, if a work is likewise defended by small-arms, if the one is destroyed, the other will still subsist.

5. All the defences should be as nearly direct as possible; for it has been found by experience, that the soldiers are too apt to fire directly before them, without troubling themselves whether they do execution or not.

6. A fortification should be equally strong on all sides; otherwise the enemy will attack it in

the weakest part, whereby its strength will become useless.

7. The more acute the angle at the centre is, the stronger will be the place.

8. In great places, dry ditches are preferable to those filled with water, because sallies, retreats, succours, &c. are necessary; but, in small fortresses, wet ditches, that can be drained, are the best, as standing in need of no sallies.

Field-FORTIFICATION, is the art of fortifying, constructing, attacking, and defending, all sorts of temporary field-works during a campaign.

Different authors recommend different methods of fortification; but the principal are those of Pagan, Blondel, Vauban, Coehorn, Belidor, Scheiter, and Muller.

FORTIFICATION, according to the method of Pagan, consists in three different forts, viz. the great, the mean, and little, whose principal dimensions are contained in the following

TABLE.

The great FORTIFICATION.			The mean.		The little.	
	for squares	for all other polygons	for squares	for all other polygons	for squares	for all other polygons
Exterior side -	200	200	180	180	160	160
The perpendicular	27	30	24	30	21	30
The face - -	60	60	55	55	45	50
The flank - -	22	24	19	24	18	23
The curtain - -	73	70	63	60	63	50
The line of defence	141	141	126	126	115	112

Blondel fortifies within the given polygon: he establishes two forts of fortification; the great one, whose exterior side is 200 toises, and the lesser one 170; because he will not have the line of defence exceed 140 toises, which is the greatest musket-shot, nor less than 120 toises, not to increase the number of bastions. He begins by the diminishing angle, which

may be found by taking 90 degrees from the angle of the polygon, and by adding 15 degrees to the third of the remainder.

Vauban's method is divided into little, mean, and great: the little is chiefly used in the construction of citadels; the mean, in that of all sorts of towns; and the great, in particular cases only.

TABLE.

TABLE.

	Forts						Little				Mean		Great	
Side of polygon	80	90	100	110	120	130	140	150	160	170	180	190	200	260
Perpendicular	10	11	12½	14	15	16	20	21	23	25	30	31	25	22
Faces bastion	22	25	28	30	33	35	40	42	45	47	50	53	55	60
Cap. of Ravel.	25	28	30	35	38	40	45	50	50	52	55	55	60	50

In the first vertical column are the numbers expressing the lengths of the exterior sides from 80 to 260.

In the second, the perpendiculars answering to these sides.

In the third, the lengths of the faces of the bastions; and in the fourth, the lengths of the capitals of the ravelins.

Belidor's method is divided also into little, mean, and great: and in all three the exterior side is 200 toises; the perpendicular of the little is 50, that of the mean 55, and the great 40: the faces of the first 70, the second 70, and the third 55 toises.

Scheiter's method is divided into the great, mean, and small fort. The exterior side of the polygon for the great fort is 200 toises, the mean fort 180, and the small 160. The line of defence in the first is 140 toises, the second 130, and the third 120. This line is always razant. All the other lines are fixed at the same length for all polygons, whose structure chiefly depends upon the knowledge of the exterior side, of the capital, or of the flanked angle, the rest being easily finished.—See the TABLE.

TABLE of capitals and flanked angles.

Polygons	IV	V	VI	VII	VIII	IX	X	XI	XII
The flanked angles in the 3 forts of fortification.	deg. 64	76	84	90	95	97	99	101	103
Capital for the great fort.	toises 46	49	51	52	53	54½	56½	58	59
Capital for the mean fort.	42	44½	46½	48½	50	51	52½	54	54
Capital for the small fort.	39	41½	42½	45	46	47½	48½	50	50½

FORTIN, FORTLETT. See FIELD-FORT.

FOSS, in fortification. See DITCH.

FOUCADE, FOUGADE, in mining. See Fougass.

FOUNDATION, in military architecture, is that part of a building which is under ground, or the mass of stone, brick, &c. which supports a building, or upon which the walls of a superstructure are raised: or it is the coffer or bed dug below the level of the ground, to raise a building upon; in which sense, the foundation either goes to the whole area or extent of the building, as when there are to be vaults, galleries, casemates, or the like; or is drawn in cuts or trenches, as when only walls are to be raised. Sometimes the foundation is massive,

and continued under the whole building, as in the antique arches and aqueducts; but it is more usually in spaces or intervals; in which latter case, insulated pillars, bound together by arches, should be used.

There are several things to be well considered in laying the foundation of a military building. We must first examine the bed of the earth upon which we are to build, and then the under fillings or substruction. We are not to rest upon any appearing solidity, unless the whole mould through which we cut has likewise been solid; and in such cases, allow 1-6th part of the height of the building for the hollowing or under-digging, unless there be cellars under ground, in which case it may be something less. There

There are many ways to try the firmness of the ground; but the following, in our opinion, is the best. Take an iron crow, or such a borer as well-diggers use, which at once will point out the goodness and tenacity of the ground.

Engineers should use the utmost diligence in this point; for, of all the errors that may happen in building, those are the most pernicious which are committed in the foundation, because they bring with them the ruin of the whole building; nor can they be amended without very great difficulty.

FOUNDATIONS are either natural, or artificial: natural, as when we build on a rock, or very solid earth; in which case we need not seek for any other strengthening; for these, without digging, or other artificial helps, are of themselves excellent *foundations*, and most fit to uphold the greatest buildings. But if the ground be sandy or marshy, or have lately been dug, in such case recourse must be had to art. In the former case, the engineer must adjust the depth of the *foundation* by the height, weight, &c. of the building: 1-6th part of the whole height is looked upon as a medium; and as to the thickness, double that of the width of a wall is a good rule. If you build upon mossy and loose earth, then you must dig 'till you find sound ground. This sound ground, fit to support a building, is of divers kinds: in some places so hard, as scarcely to be cut with iron; in other places very stiff; in other places blackish, which is accounted the weakest; in others like chalk, and in others sandy: but of all these, that is the best which requires most labour in cutting or digging, and when wet, does not dissolve into dirt.

If the earth to be built upon is very soft, as in mossy grounds, or such that the natural *foundation* cannot be trusted, then you must get good pieces of oak, whose length must be the breadth of the trench, or about 2 feet longer than the wall: these must be laid across the *foundation*, about 2 feet asunder, and being well rammed down, lay long planks upon them; which planks need not lie so broad as the pieces are long, but only about four inches on a side wider than the basis or foot of the wall is to be. But if the ground be so very bad, that this will not do, then you must provide good piles of oak, of such a length as will reach the good ground, and whose diameter must be about 1-12th part of their length. These piles must be driven down by an engine for that purpose, and must be placed as close as one can stand by another; then lay

planks upon them, and pin them fast. But if the ground be faulty in some parts, and firm in others, you may turn arches over those loose places, which will discharge them of the weight. You must not forget to place the piles under the inner, as well as the outer walls; for if these should sink, it would be a means to make the outer walls crack, and so ruin the whole building.

Having thus far considered the bed of the earth on which the building is to be erected, we shall next consider the substruction, as it was called by the ancients; but our modern engineers call it the *foundation*. This is the ground-work of the whole edifice, which must sustain the walls, and is a kind of artificial, as the other was natural; as to which, these things that follow are most necessary to be observed.

1. That the bottom be exactly level; therefore lay a platform of good boards.
2. That the lowest ledge or row be all of stone, the broader the better, laid closely without mortar; which is a general caution for all parts of a building that are contiguous to board or timber; because lime and wood are utter enemies to one another, and, if unfit confiners any where, they are more especially so in the foundation.
3. That the breadth of the *foundation* be at least double the breadth of the wall that is to be raised upon it: but even in this case art should give way to discretion; and the foundation may be made either broader or narrower, according as the ground, and the ponderosity of the edifice, require.
4. That the *foundation* be made to diminish as it rises, but yet so that there may be as much left on the one side as on the other; so that the middle of that above may be perpendicularly over the middle of that below, which should in like manner be observed in diminishing the walls above ground; for by this means the building will become much stronger than it would be if the diminution were made any other way.
5. That you should never build on the ruins of an old foundation, unless you are well assured of its depth, and that its strength is sufficient to bear the building.

The stones in the *foundation* should be laid as they naturally lay in the quarry, for they have the most strength in their natural position. This should be observed in all parts of a building, because all stones have a cleaving grain; consequently, if the horizontal position of the stones in the quarry should be placed vertically in the building, the super-incumbent

cumbent weight would be apt to cleave them, and so render the building ruinous.

FOUNDRY, } in *military matters*, the art
FOUNDRY, } of casting all kinds of ordnance, such as cannon, mortars, howitzers, &c. It likewise signifies the place or work-house wherein these operations are performed. At present all pieces of artillery are cast solid, and bored afterwards. Formerly guns were bored perpendicularly, but at present in a horizontal position: the boring instrument is fixed immoveably, and forced into the gun or mortar by a mechanical power. The piece of artillery is turned round by a large wheel and horses; and at the same time the gun is bored, the outside is turned and polished, by another very curious machine for that purpose, invented by the very ingenious Messrs. Verbruggen, founders at Woolwich. Guns were first founded in England in 1587.

FOURNEAU, in *mining*. See **CHAMBER**. See **MINE**.

FOUGASS, in *mining*, a small mine, from 6 to 8 feet under ground: they are generally placed under the glacis or dry ditches.

FOYER, in *mining*. See **MINE**.

FRAISE, in *fortification*, a kind of stakes or palisades placed horizontally on the outward slope of a rampart made of earth, to prevent the work being taken by surprise. They are generally 7 or 8 feet long, and about 5 inches thick. When an army intrenches itself, they often fraise the parapets of their retrenchments in the parts most exposed to an attack.

To *FRAISE a battalion*, is to line or cover it every way with pikes, that it may withstand the shock of a body of horse.

FRICTION, in *mechanics*, the rubbing of the parts of engines and machines against each other, by which a considerable part of their effect is destroyed.

It is hardly possible to lay down general rules for computing the quantity of friction, because it depends upon a multiplicity of circumstances, as the structure, firmness, elasticity, &c. of bodies rubbing against each other. Some authors make the friction upon a horizontal plane, equal to 1-3d of the weight to be moved; while others have found it to be considerably less. But however this be, the doctrine of friction, as ascertained by the latest experiments, may be summed up in the following manner.

1. When one body rests on another upon a horizontal plane, it presses it with its whole weight, which being equally re-acted upon, and consequently the whole effect of its gravity de-

stroyed by the plane, it will be absolutely free to move in any horizontal direction by any the least power applied thereto, provided both the touching surfaces be smooth.

2. But since we find no such thing as perfect smoothness in the surfaces of bodies, arising from their porosity and peculiar texture, it is easy to understand, that when two such surfaces come together, the prominent parts of the one will, in some measure, fall into the concave parts of the other: and therefore, when an horizontal motion is attempted in one, the fixed prominent parts of the other will give more or less resistance to the moving surface, by holding and retaining its parts; and this is what we call friction.

3. Now since any body will require a force equal to its weight, to draw it over a given obstacle, it follows that the friction arising to the moving body, will always be in proportion to its weight only, and not to the quantity of the surface, by which it bears upon the resisting plane or surface. Thus if a piece of wood 4 inches wide, and 1 thick, be laid upon another fixed piece of the same wood, it will require the same weight to draw it along, whether it be laid on its broad or narrow side.

4. For, though there be 4 times the number of touching particles on the broad side (*ceteris paribus*) yet each particle is pressed but with 1-4th of the weight that those are on the narrow side; and since 4 times the number, multiplied by 1-4th of the weight, it is plain the resistance is equal in both places, and so requires the same force to overcome it.

5. The reason why friction is proportional to the weight of the moving body, is, because the power applied to move the body must raise it over the prominent parts of the surface on which it is drawn; and this motion of the body, as it is not upright, will not require a power equal to its whole weight; but being in the nature of the motion on an inclined plane, it will only require a part of its own weight, which will vary with the various degrees of smoothness and asperity.

6. It is found by experiment, that a body will be drawn along by nearly 1-3d of its weight; and if the surfaces be hard and well polished, by less than 1-3d part; whereas, if the parts be soft or rugged, it will require a much greater weight.

The ingenious Mr. Emerson, in his principles of Mechanics, has given us the following rules deduced from experiments; but they require some variation under different circumstances, which must be left to the judgment of the artist.

1. Wood

1. Wood and all metals, when greased, have nearly the same friction; and the smoother they are, the less friction they have; yet metals may be so far polished as to increase friction by the cohesion of their parts.

Wood slides easier upon the ground in wet weather than in dry, and easier than iron in dry weather; but iron slides easier than wood in wet weather. Lead makes a great deal of resistance. Iron or steel running in brass, makes the least friction of any. In wood acting against wood, grease makes the motion twice as easy, or rather 2-3ds easier. Wheel-naves, greased or tarred, go 4 times easier than when wet.

Metals oiled make the friction less than when polished, and twice as little as when unpolished.

In general, the softer or rougher the bodies, the greater their friction.

2. As to particular cases: a cubic piece of soft wood of 8 pounds weight, moving upon a smooth plane of soft wood, at the rate of 3 feet per second; its friction is about 1-3d of the weight of it; but if it be rough, the friction is little less than 1-half the weight.

Upon the same supposition, other soft wood upon soft wood very smooth, the friction is about 1-4th of the weight.

Soft wood upon hard, or hard wood upon soft, 1-5th or 1-half of the weight. Hard wood upon hard wood, 1-7th or 1-8th of the weight.

Polished steel moving upon steel or pewter, 1-4th of the weight; moving on copper or lead, 1-5th of the weight; on brass, 1-5th of the weight. Metals of the same sort have more friction than different sorts.

The friction, *ceteris paribus*, increases with the weight almost in the same proportion. The friction is also greater with a greater velocity, but not in proportion to it, except in very few cases. A greater surface also causes something more friction, with the same weight and velocity; yet friction may sometimes be increased by having too little surface to move on; as upon clay, &c. where the body sinks.

3. The friction arising from the bending of ropes about machines, differs according to their stiffness, the temper of the weather, degree of flexibility, &c. but, *ceteris paribus*, the force or difficulty of bending a rope is as the square of the diameter of the rope, and its tension, directly; and the diameter of the cylinder or pulley it goes about, reciprocally.

A rope of 1 inch diameter, whose tension or weight drawing it is 5 pounds, going over a pulley 3 inches diameter, requires a force of 1 pound to bend it.

4. The resistance of a plane moving through a fluid is as the square of the velocity; and putting v = velocity in feet in a second; it is

equal to the weight of a column of the fluid, whose base is the plane, and height $\frac{vv}{64}$. And in a globe it is but half so much.

5. As to the mechanic powers, the single lever makes no resistance by friction; but if, by the motion of the lever in lifting, the fulcrum, or place of support, be changed further from the weight, the power will be decreased thereby.

6. In any wheel of any machine, running upon an axis, the friction on the axis is as the weight upon it, the diameter of the axis, and the angular velocity. This sort of friction is but small.

7. In the pulley, if p, q , be 2 weights, and q the greater; and $w = \frac{pq}{p+q}$, then w is the weight upon the axis of the single pulley; and it is not increased by the acceleration of the weight q , but remains always the same.

The friction of the pulleys is very considerable, when the sheaves rub against the blocks; and by the wearing of the holes and axles.

The friction of the axis of the pulley is as the weight w , its angular velocity, the diameter of the axis directly, and the diameter of the pulley inversely. A power of 100 pounds, with the addition of 50 pounds, will but draw up 500 with a tackle of 5; and 15 pounds over a single pulley will draw up only 14 pounds.

8. In the screw, there is a great deal of friction: those with sharp threads have more friction than those with square threads; and end-less screws have more than either. Screws with a square thread raise a weight with more ease than those with a sharp thread.

In the common screw the friction is so great, that it will sustain the weight in any position given, when the power is taken off; and therefore the friction is at least equal to the power. From whence it will follow, that in the screw, the power must be to the weight or resistance, at least as twice the perpendicular height of a thread, to the circumference described by one revolution of the power; if it be able to raise the weight, or only sustain it. This friction of the screw is of great use, as it serves to keep the weight in any given position.

9. In the wedge, the friction is at least equal to the power, as it retains any position it is driven into; therefore in the wedge, the power must be to the weight at least as twice the base to the height, to overcome any resistance.

10. To find the friction of any engine, begin at the power, and consider the velocity and the weight at the first rubbing part; and estimate its quantity of friction by some of the foregoing articles; then proceed to the next rubbing

rubbing part, and do the same for it, and so on through the whole.

And note, that something more is to be allowed for increase of friction by every new addition to the power.

FRONT, of a *regiment*, the foremost rank of a battalion, squadron, or any other body of men. To front every way, is when the men are faced to all sides.

FRONT of a *fortification*. See **FACE**.

FURLOUGH, in *military matters*, a licence granted by an officer to a soldier, to be absent for a time from his duty. All soldiers found half a league from a camp or garrison, going towards an enemy's country, or quarters, with-

out a pass, are deemed and treated as deserters.

FUNERALS. See **BURIALS**.

FUZE. See **LABORATORY**.

FUZILIERS, in *military matters*, are soldiers armed as the rest of the infantry, but wearing caps like the grenadiers, though somewhat shorter. There are three regiments in the English service: the royal regiment of Scotch Fuziliers, raised in 1678; the royal regiment of English Fuziliers, raised in 1685; and the royal regiment of Welsh Fuziliers, raised in 1688-9.

FUZEE, or **FUSEE**. See **FIRELOCK**. See **MUSKET**.

FYF-MAJOR. See **MAJOR**.

G

GABIONS, in *fortification*, are a kind of baskets made of osier-twigs, of a cylindrical form, having different dimensions, according to what purpose they are used. Some are 5 or 6 feet high, and 3 feet in diameter: these serve in sieges to carry on the approaches under cover, when they come pretty near the fortification. Those used in field-works are 3 or 4 feet high, and 2½ or 3 feet diameter. There is also a kind of gabions, about 1 foot high, 12 inches diameter at top, and from 8 to 10 at bottom, which are placed along the top of the parapet, to cover the troops in firing over it.

In order to make them, some pickets, 3 or 4 feet long, are struck into the ground, in form of a circle, and of a proper diameter, wattled together with small branches, in the manner of common fences. Batteries are often made of gabions. See **BATTERY**.

Stuff-GABIONS, in *fortification*, are made in the same manner as the former: they are only filled with all sorts of branches and small wood, and are 4 or 6 feet long: they serve to roll before the workman in the trenches, to cover them in front against musket-shot.

GALLERY, } in *fortification*. See **SIEGE**.
 } of a *mine*. See **MINE**.

GALLOPER-Carriage, in *artillery*. See **CARRIAGE**.

GANTLET, } in *ancient military history*, a
GAUNTLET, } large kind of glove, made of iron, and the fingers covered with small plates: it was formerly worn by cavaliers, single knights of war, when armed at all points.

GANTLOPE, denotes a kind of military

punishment, in which the criminal running between the ranks receives a lash from each man. See *Run the gantlope*.

GARDENS, in our *ancient military history*, were of two different kinds, viz.

Artillery-GARDEN, about the year 1650, was a famous place in London, where vast numbers of young people took great delight in every kind of artillery exercises, in so far that it was famous through the whole world, and universally stiled the great nursery, or academy of military discipline.

Military-GARDEN, was likewise famous, about the year 1650, in the city of London, for the great improvement of numbers of our nobility, and other gentlemen of fashion, in every kind of military exercise. The captains in chief of those academies or gardens were major-general Skippon, and major Tillyer.

GARNISH-bolt, or *nails*. See **CARRIAGE**.

GARRISON, in the *art of war*, a body of forces, disposed in a fortress or garrison town, to defend it against the enemy, or to keep the inhabitants in subjection; or even to be subsisted during the winter season: hence garrison and winter-quarters are sometimes used indifferently, for the same thing; and sometimes they denote different things. In the latter case, a garrison is a place wherein forces are maintained to secure it, and where they keep regular guard, as a frontier town, a citadel, castle, tower, &c. The garrison should always be stronger than the townsmen.

Winter-quarters signifies a place where a number of forces are laid up in the winter season, without keeping the regular guard. See **WINTER-QUARTERS**.

GARRISON-town, generally a strong place in which troops are quartered, and do duty, for the security thereof, keeping strong guards at each port, and a main-guard in or near the market-place.

Order of the GARTER, a military order of knighthood, the most noble and ancient of any lay-order in the world, instituted by king Edward III. This famous order consists of 26 knights companions, generally princes and peers, whereof the king of England is the sovereign or chief. They are a college or corporation, having a great and little seal.

Their officers are a prelate, chancellor, register, king at arms, and usher of the black rod. They have also a dean and 12 canons, and petty canons, vergers, and 26 pensioners, or poor knights. The prelate is the head. This office is vested in the bishop of Winchester, and has ever been so. Next to the prelate is the chancellor; which office is vested in the bishop of Salisbury, who keeps the seals, &c. The next is the register, who by his oath is to enter upon the registry, the scrutinies, elections, penalties, and other acts of the order, with fidelity. The fourth officer is Garter, and king at arms, being two distinct offices united in one person. Garter carries the rod and sceptre at the feast of St. George, the protector of this order, when the sovereign is present. He notifies the elections of new knights, attends the solemnity of their installations, carries the garter to the foreign princes, &c. He is the principal officer within the college of arms, and chief of the heralds.

All these officers, except the prelate, have fees and pensions. The college of the order is seated in the castle of Windsor, with the chapel of St. George, and the chapter-house, erected by the founder for that purpose. The habit and ensign of the order are, a garter, mantle, cap, george, and collar. The 4 first were assigned the knights companions by the founders; and the george and collar by king Henry VIII. The garter challenges pre-eminence over all other parts of the dress, by reason that from it the noble order is denominated; that it is the first part of the habit presented to foreign princes, and absent knights, who, and all other knights elect, are therewith first adorned; and it is of such honour and grandeur, that by the bare investiture with this noble ensign, the knights are esteemed companions of the greatest military order in the world. It is worn on the left leg, between the knee and calf, and is enamelled with this motto, *Honi soit qui mal y pense*; that is, "Shame to him

that thinks evil hereof." The meaning of which is, that king Edward having laid claim to the kingdom of France, retorted shame and defiance upon him that should dare to think amiss of the just enterprise he had undertaken, for recovering his lawful right to that crown; and that the bravery of those knights whom he had elected into this order, was such as would enable him to maintain the quarrel against those that thought ill of it.

The mantle is the chief of those vestments made use of upon all solemn occasions. The colour of the mantle is by the statutes appointed to be blue. The length of the train of the mantle, only, distinguishes the sovereign from the knights companions. To the collar of the mantle is fixed a pair of long strings, anciently wove with blue silk only, but now twisted round, and made of Venice gold and silk, of the colour of the robe, with buttons and tassels at the end. The left shoulder of the mantle is adorned with a large garter, and device *Honi soit*, &c. Within this is the cross of the order, which was ordained to be worn at all times, by king Charles I. At length the star was introduced, being a sort of cross irradiated with beams of silver.

The collar is composed of pieces of gold in fashion of garters, the ground enamelled blue, and the motto gold.

The garter is of blue velvet bordered with fine gold wire, having commonly the letters of the motto of the same: it is, at the time of election, buckled upon the left leg, by 2 of the senior companions, who receive it from the sovereign, to whom it was presented upon a velvet cushion by garter king at arms, with the usual reverence, whilst the chancellor reads the following admonition, enjoined by the statutes. "To the honour of God omnipotent, and in memorial of the blessed martyr St. George, tie about the leg, for thy renown, this noble garter; wear it as the symbol of the most illustrious order, never to be forgotten, or laid aside; that thereby thou mayest be admonished to be courageous, and having undertaken a just war, in which thou shalt be engaged, thou mayest stand firm, valiantly fight, and successfully conquer."

The princely garter being thus buckled on, and the words of its signification pronounced, the knight elect is brought before the sovereign, who puts about his neck, kneeling, a sky-coloured ribbon, whereon is appendant, wrought in gold within the garter, the image of St. George on horseback, with his sword drawn, encountering with the dragon. In the mean time the chancellor reads the following ad-

admonition: "Wear this ribbon about thy neck, adorned with the image of the blessed martyr and soldier of Christ, St. George, by whose imitation provoked, thou mayest so overpass both prosperous and adverse adventures, that having stoutly vanquished thy enemies both of body and soul, thou mayest not only receive the praise of this transient combat, but be crowned with the palm of eternal victory."

Then the knight elected kisses his sovereign's hand, thanks his majesty for the great honour done him, rises up, and salutes all his companions severally, who return their congratulations.

Since the institution of this order, there have been 8 emperors, and 28 kings, besides numerous sovereign princes, enrolled as companions thereof. Its origin is somewhat differently related: the common account is, that it was erected in honour of a garter of the countess of Salisbury, which she dropped dancing with king Edward, and which that prince picked up; but our best antiquaries think it was instituted on account of the victory over the French at Cressy, where the king ordered his garter to be displayed as a signal of the battle.

GATE, in a *military sense*, is made of strong planks with iron bars to oppose an enemy. They are generally made in the middle of the curtain, from whence they are seen and defended by the 2 flanks of the bastions. They should be covered with a good ravelin, that they may not be seen or enfiladed by the enemy. The palisades and barriers before the gates within the town are often of great use. The fewer ports there are in a fortress, the more you are secured against the enemy. At the opening of a gate, a party of horse is sent out to patrol in the country round the place, to discover ambuscades or lurking parties of the enemy, and to see if the country be clear.

GAUNTELOPE. } See GANTLOPE. *Run the GAUNTLET.* } GANTLOPE.

GAZONS, in *fortification*, are pieces of fresh earth or sods, covered with grass, and cut in form of a wedge, about a foot long, and half a foot thick, to line the outsides of a work made of earth; as ramparts, parapets, banquettes, &c. The first bed of gazons is fixed with pegs of wood; and the second bed is so laid as to bind the former, by being placed over its joints; and so continued 'till the works are finished. Betwixt those sods it is usual to sow all sorts of binding weeds or herbs, in order to strengthen the rampart.

GENDARMES, } in the *French armies*, a
GENS D'ARMES, } denomination given to a select body of horse, on account of their succeeding the ancient gendarmes, who were thus called from their being completely clothed in armour. These troops are commanded by captain-lieutenants; the king, and the princes of the blood, being their captains: the king's troop, besides a captain-lieutenant, has 2 sub-lieutenants, 3 ensigns, and 3 guidons. Established in France in 1422.

Grand GENDARMES, at present are a troop composed of 250 gentlemen: the king himself is their captain, and one of the first peers their captain-lieutenant, who has under him 2 lieutenants, 3 ensigns, 3 guidons, and other officers.

Small GENDARMERY, are the Scotch gendarmes, the queen's, the dauphin's, the gendarmes of Anjou, Burgundy, the English and Flemish gendarmes, having each a captain-lieutenant, sub-lieutenant, ensign, guidon, and quarter-master.

GENERAL, in a *military sense*, is an officer in chief, to whom the prince has judged proper to intrust the command of his troops; and this, whether he is known by the name of Captain-general, as in England and Spain, Feldt marschal, as in Germany, or Marschal, as in France.

The natural qualities of a GENERAL, should be a martial genius, a solid judgement, a healthy robust constitution, intrepidity and presence of mind on critical occasions, indefatigability in business, goodness of heart, liberality, birth; the more illustrious it is, the more it commands respect: a reasonable age; if too young, he may want experience and prudence; if too old, he may not have vivacity enough: an uniform conduct, an affable humour, but inflexible in maintaining the police and discipline of an army.

Acquired qualities of a GENERAL, are secrecy, justice, sobriety, temperance, knowledge of the art of war from theory and practice, the art of commanding, and speaking with precision and exactness; great attention to preserve the lives and supply the wants of the soldiers, and a constant study of the characters of the officers of his army, that he may employ them according to their talents. His conduct appears in establishing his magazines in the most convenient places; in examining the country, that he may not engage his troops too far, while he is ignorant of the means of bringing them off; in subsisting them, and in knowing how to take the most advantageous posts,

posts, either for fighting, retreating, or shunning a battle. His experience inspires his army with confidence, and in assurance of victory; and his quality, by creating respect, augments his authority. By his liberality he gets intelligence of the strength and designs of the enemy, and by this means is enabled to take the most successful measures. He ought to be fond of glory, to have an aversion to flattery, to render himself beloved, and to keep a strict discipline and a regular subordination.

The office of a GENERAL, is to regulate the march and encampment of the army; in the day of battle to chuse out the most advantageous ground; to make the disposition of the army; to post the artillery, and, where there is occasion, to send his orders by his aids-de-camp. At a siege he is to cause the place to be invested, to regulate the approaches and attacks, to visit the works, and to send out detachments to secure the convoy, and foraging parties.

GENERAL, is also used for a particular beat of the drum. See *DRUM*.

GENERALISSIMO, a supreme and absolute commander in the field. This word is generally used in most foreign languages. (See *GENERAL*.) It was first invented by the absolute authority of cardinal Richelieu, when he went to command the French army in Italy.

GENERAL of the artillery. See *ORDNANCE*.

GENERALS of horse, are posts next under the general of the army. They have an absolute command over the horse of an army, above the lieutenant-generals.

GENERALS of foot, are posts next under the general of the army, having an absolute command over the foot of the army. See *GENERAL*.

Adjutant-GENERAL, one who attends the general, assists in council, and carries the general's orders to the army. He distributes the daily orders to the majors of brigade. He is likewise charged with the general detail of the duty of the army. The majors of brigade send every morning to the adjutant-general an exact return, by battalion and company, of the men of his brigade. In a day of battle the adjutant-general sees the infantry drawn up; after which, he places himself by the general, to receive any orders which may regard the corps of which he has the detail. In a siege, he orders the number of workmen demanded, and signs the warrants for their payment. He receives the guards of the trenches at their rendezvous, and examines their condition; he gives and signs all orders for parties. He has an orderly serjeant

from each brigade of infantry in the line, to carry such orders as he may have occasion to send from the general.

Lieutenant-GENERAL, is the next in command after the general; and provided he should die or be killed, the order is, that the oldest lieutenant-general shall take the command. This office is the first military dignity after that of a general. One part of their function is, to assist the general with their counsel: they ought therefore, if possible, to possess the same qualities with the general himself, and the more, as they often command armies in chief.

The number of lieutenant-generals have been multiplied of late in Europe, in proportion as the armies have become numerous. They serve either in the field, or in sieges, according to the dates of their commissions. In battle the oldest commands the right wing of the army, the second the left wing, the third the centre, the fourth the right wing of the second line, the fifth the left wing, the sixth the centre, and so on. In sieges the lieutenant-generals always command the right of the principal attack, and order what they judge proper for the advancement of the siege, during the 24 hours they are in the trenches, except the attacks, which they are not to make without an order from the general in chief.

Lieutenant-GENERAL of the ordnance. See *ORDNANCE*.

Lieutenant-GENERAL of artillery, is, or ought to be, a very great mathematician, and an able engineer, to know all the powers of artillery, to understand the attack and defence of fortified places, in all its different branches; how to dispose of the artillery in the day of battle to the best advantage; to conduct its march and retreat; as also to be well acquainted with all the numerous apparatus belonging to the train, and to the laboratory, &c.

Major-GENERAL, the next officer to the lieutenant-general: his chief business is to receive orders from the general, or in his absence from the lieutenant-general of the day; which he is to distribute to the brigade-majors, with whom he is to regulate the guards, convoys, detachments, &c. On him the whole fatigue and detail of duty of the army roll. It is the major-general of the day who is charged with the encampment of the army, who places himself at the head of it when they march, who marks out the ground of the camp to the quarter-master-general, and who places the new guards for the safety of the camp.

The day the army is to march, he dictates to the field-officers the order of the march, which he

he has received from the general, and on other days gives them the parole.

In a fixed camp he is charged with the foraging, with reconnoitring the ground for it, and posting the escorts, &c.

In sieges, if there are two separate attacks, the second belongs to him; but if there is but one, he takes either from the right or left of the attack, that which the lieutenant-general has not chosen.

When the army is under arms, he assists the lieutenant-general, whose orders he executes.

If the army marches to an engagement, his post is at the head of the guards of the army, until they are near enough to the enemy to rejoin their different corps; after which he retires to his own proper post; for the major-generals are disposed on the order of battle as the lieutenant-generals are, to whom, however, they are subordinate, for the command of their divisions. The major-general has one aid-de-camp, paid for executing his orders.

GENIUS, in a *military sense*, a natural talent or disposition to every kind of warlike employment, more than any other; or the aptitude a man has received from nature to perform well, and easily, that which others can do but indifferently, and with a great deal of pains.

From the diversity of genius, the difference of inclination arises in men, whom Nature has had the precaution of leading to the employments for which she designs them, with more or less impetuosity, in proportion to the greater or lesser number of obstacles they have to surmount, in order to render themselves capable of answering this occasion. Thus the inclinations of men are so very different, because they follow the same mover, that is, the impulse of their genius. This, as with the general in chief, is what renders one officer more pleasing, even though he trespasses against the rules of war; while others are disagreeable, notwithstanding their strict regularity.

GENOUILLIERE. See FORTIFICATION.

GENS D'ARMES. See GENDARMES.

GEODÆSIA. See SURVEYING.

GEOGRAPHY, is the doctrine or knowledge of the terrestrial globe; or the science that teaches and explains the state of the earth, and parts thereof that depend upon quantity; or it is rather that part of mixed mathematics, which explains the state of the earth, and of its parts depending on quantity, viz. its figure, magnitude, place, and motion, with the celestial appearances, &c. In consequence of this definition, geography should be divided into general and special, or universal and particular.

By *universal* GEOGRAPHY, is understood that part of the science which considers the whole earth in general, and explains its properties without regard to particular countries. This division is again distinguished into 3 parts, absolute, relative, and comparative. The absolute part respects the body of the earth itself, its parts and peculiar properties; as its figure, magnitude, and motion; its lands, seas, and rivers, &c. The relative part accounts for the appearances and accidents that happen to it from celestial causes; and, lastly, the comparative contains an explanation of those properties which arise from comparing different parts of the earth together.

Special or *particular* GEOGRAPHY, is that division of the science which describes the constitution and situation of each single country by itself; and is two-fold, viz. chorographical, which describes countries of a considerable extent; or topographical, which gives a view of some place, or small tract of land. Hence the object or subject of geography is the earth, especially its superficies and exterior parts.

The *properties* of GEOGRAPHY are of 3 kinds, viz. celestial, terrestrial, and human. The celestial properties are such as affect us by reason of the apparent motion of the sun and stars. These are 8 in number.

1. The elevation of the pole, or the distance of a place from the equator.
2. The obliquity of the diurnal motion of the stars above the horizon of the place.
3. The time of the longest and shortest day.
4. The climate and zone.
5. Heat, cold, and the seasons of the year; with rain, snow, wind, and other meteors.
6. The rising, appearance, and continuance of stars above the horizon.
7. The stars that pass through the zenith of a place.
8. The celerity of the motion with which, according to the Copernican hypothesis, every place constantly revolves.

The *terrestrial* properties are those observed in the face of each country, and are likewise 10 in number.

1. The limits and bounds of each country;
2. } figure;
3. } magnitude;
4. } mountains;
5. } waters, viz. springs, rivers, lakes, and bays;
6. } woods and deserts;
7. The fruitfulness and barrenness of the country, with its various kinds of fruits;
8. The

8. } minerals and fossils ;
 9. } The { living creatures there ;
 10. } { longitude and latitude of the place.

The third kind of observations to be made in every country is called human, because they chiefly regard the inhabitants of the place ; and these are also 10 in number.

1. Their stature, shape, colour, and the length of their lives ; their origin, meat and drink.

2. Their arts, and the profits which arise from them, with the merchandize they barter one with another.

3. Their virtues and vices, learning, capacities, and schools.

4. Their ceremonies at births, marriages, and funerals.

5. The language which the inhabitants use.

6. } political government.
 7. } Their { religion and church government.
 8. } { cities and famous places.
 9. } { remarkable histories & antiquities

10. Their famous men, artificers, and inventions of the natives.

These are the three kinds of occurrences to be explained in special geography.

The principles of GEOGRAPHY, or those from which arguments are drawn for proving of propositions in that science, are, according to the best authors, of three sorts :

1. Geometrical, arithmetical, and trigonometrical propositions.

2. Astronomical precepts and theorems.

3. Experience, being that upon which the greatest part of geography, and chiefly the special, is founded.

In proving geographical propositions, we are to observe, that several properties, and chiefly the celestial, are confirmed by proper demonstrations ; being either grounded on experience and observation, or on the testimony of our senses : nor can they be proved by any other means. There are also several propositions proved, or rather exposed to view, by the terrestrial globe, or by geographical maps.

Other propositions cannot be so well proved, yet are received as apparent truths. Thus, though we suppose all places on the globe, and in maps, to be laid down in the same order as they are really on the earth ; nevertheless, in these matters, we rather follow the descriptions that are given by geographical writers.

GEOGRAPHY is very ancient, at least the special part thereof ; for the ancients scarce went beyond the description of countries. It was a constant custom among the Romans, after they had conquered or subdued any province, to have a map or printed representation thereof, carried in triumph, and exposed to

the view of the spectators. Historians relate, that the Roman senate, about 100 years before Christ, sent geographers into divers parts to make an exact survey and mensuration of the whole globe ; but they scarce ever saw the 20th part of it.

Before them, Necho, king of Egypt, ordered the Phœnicians to make a survey of the whole coast of Africa, which they accomplished in 3 years. Darius procured the Ethiopic sea, and the mouth of the Indus, to be surveyed ; and Pliny relates, that Alexander, in his expedition into Asia, took 2 geographers to measure and describe the roads ; and that from their itineraries, the writers of the following ages took many particulars. Indeed this may be observed, that whereas most other arts and sciences are sufferers by war, geography, artillery, mining, and fortification, alone have been improved thereby. Geography, however, must have been exceedingly defective, as a great part of the globe was then unknown, particularly all America, the northern parts of Europe and Asia, with the Terra Australis, and Magellanica ; and they were also ignorant of the earth's being capable to be failed round, and of the torrid zone's being habitable, &c.

The honour of reducing geography to art and system, was reserved for Ptolemy, who, by adding mathematical advantages to the historical method in which it had been treated of before, has described the world in a much more intelligible manner : he has delineated it under more certain rules, and by fixing the bounds of places from longitude and latitude, hath discovered other mistakes, and has left us a method of discovering his own.

GEOMETRY, originally signified no more than the art of measuring the earth, or any distances or dimensions within it ; but at present it denotes the science of magnitude in general ; comprehending the doctrine and relations of whatever is susceptible of augmentation or diminution, considered in that light. Hence, to geometry may be referred the consideration not only of lines, surfaces and solids ; but also of time, velocity, number, weight, &c.

Plato thought the word geometry an improper name for this science, and accordingly substituted in its place the more extensive one of mensuration ; and, after him, others gave it the name of pantometry, as demonstrating not only the quantities of all manner of magnitudes, but also their qualities, ratios, positions, transformations, relations, &c. and Pappus calls it the knowledge of magnitudes and figures, and their limitations ; also of their motions, and affections of every kind.

Origin

Origin and progress of GEOMETRY. This science had its rise among the Egyptians, who were in a manner compelled to invent it, to remedy the confusion which generally happened in their lands, from the inundations of the river Nile, which carried away all their boundaries, and effaced all the limits of their possessions. Thus, this invention, which at first consisted only in measuring the lands, that every person might have what belonged to him, was called geometry, or the art of measuring land; and it is probable, that the draughts and schemes, which they were annually compelled to make, helped them to discover many excellent properties of these figures; which speculations continued to be gradually improved, and are so to this day.

From Egypt geometry passed into Greece, where it continued to receive new improvements in the hands of Thales, Pythagoras, Archimedes, Euclid, &c. The elements of geometry, written by this last in 13 books, are a most convincing proof to what perfection this science was carried among the ancients. However, it must be acknowledged, that it fell short of modern geometry, the bounds of which, what by the invention of fluxions, and the discovery of the almost infinite order of curves, are greatly enlarged.

Division of GEOMETRY. This science is usually distinguished into elementary, and higher or sublime geometry. The first, or elementary geometry, treats of the properties of right lines, and of the circle, together with the figures and solids formed by them. The doctrine of lines comes first, then that of surfaces, and lastly that of solids. The higher geometry comprehends the doctrine of conic sections, and numerous other curves.

Speculative and practical GEOMETRY. The former treats of the properties of lines and figures, as Euclid's Elements, Apollonius's Conic Sections, &c. and the latter shews how to apply these speculations to the use of mensuration, navigation, surveying, taking heights and distances, gauging, fortification, gunnery, &c.

Usefulness of GEOMETRY. The usefulness of this science extends to almost every art and science. It is by the help of it that astronomers turn their observations to advantage; regulate the duration of times, seasons, years, cycles, and epochas; and measure the distance, motion, and magnitudes, of the heavenly bodies. It is by it that geographers determine the fi-

gure and magnitude of the whole earth; and delineate the extent and bearings of kingdoms, provinces, harbours, &c. It is from this science also, that architects derive their just measure and construction of public edifices, as well as private houses.

It is by the assistance of geometry that engineers conduct all their works, take the situation and plans of towns, the distances of places, and the measure of such things as are only accessible to the sight. It is not only an introduction to fortification, but highly necessary to most mechanics. On geometry likewise depends the theory of gunnery, mining, music, optics, perspective, drawing, mechanics, hydraulics, pneumatics, &c.

GEORGE, or *Knight of St. George*, has been the denomination of several military orders, whereof that of the garter is one of the most illustrious. See GARTER.

GIN, in *military mechanics*, is a machine for raising great weights: it is composed of three long legs, two of which are kept at a proper distance by means of two iron bars fixed on one of the legs by a staple passing through the hole at one end: the other end has a hook which enters into a staple fixed into the other leg, so as to put off or on at pleasure. At 3 feet from the bottom is a roller, upon which the cable is wound; and the 3 legs are joined together with an iron bolt, about which they move: to this bolt is also fixed an iron half-ring to hook on a windlass: when the gin stands upright, so as the legs stand at a proper distance, one end of the cable is fastened to a gun, mortar, or other weight; and the other passes through the pulleys and round the roller, which is turned round by means of hand-spikes passing through the holes in the ends of the roller: whilst a man holds the cable tight, the gun is raised to the height that the carriage may be put under it.

GLACIS. See FORTIFICATION.

GLOBE. See GEOGRAPHY.

GORGE. See FORTIFICATION.

GORGET, a kind of breast-plate, like a half-moon, with the arms of the prince thereon; worn by the officers of foot. They are to be either gilt or silver, according to the colour of the buttons on the uniforms.

GORGONS, in *military antiquity*, a warlike female nation of Lybia, in Africa, who had frequent quarrels with another nation of the same sex, called *Amazons*.

GOVERNOR of a fortification, is, or should be,

be, a person of great military knowledge; and is, however, a very considerable officer, representing the king's person, whose authority extends not only over the inhabitants and garrison, but over all troops that may be there in winter quarters, cantonments, or quarters of refreshment.

Duty of a GOVERNOR in time of peace, is to order the guards, the rounds, and the patrols; to give the parole and countersign every night after the gates are shut; to visit the posts, to see that both officers and soldiers do their duty, and to see that every thing goes on regularly, and in good order.

Duty of a GOVERNOR in time of war. He should consider the place in such a manner, as if the enemy were going to besiege him, not omitting the least thing that may contribute to a long and obstinate defence: he should therefore take particular care to keep the fortification in good repair; clearing the country round of all hedges, ditches, trees, hollow roads, caverns, and rising grounds, within the reach of cannon-shot; not suffering any houses to be built within that distance, nor in general any thing to be done that may favour the approach of an enemy.

He should consider well with himself every minute circumstance that may be of advantage to him during the siege: he should thoroughly examine the several works, and canvass all the different stratagems that may be used, either to defend them, or to give way upon occasion, when overpowered, with an intent to return and dislodge the enemy, after they have got possession of them; in short, how to defend the place entrusted to his care, inch by inch, with the best advantage. He should consider how, and in what manner, the works defend each other; whether their communications are safe, or if they may be interrupted by the besiegers; how to incommode the enemy when they are at a distance, or to dislodge them when near; if the ground be proper for mines, and where they should be made; if any part of the country may not be laid under water, by means of dikes or sluices: if there are any already made, to keep them in constant repair, or to make them if they are wanted; taking care to construct them so that the enemy may not have it in their power to destroy them, either with their cannon or mortars.

If the governor is not sufficiently skilled in the attack and defence, he should frequently

converse with the officers of engineers and artillery who understand it, examine the works together, to see what may be done to render the defence of the place as long as the circumstances and nature of the works will admit of: and to make it familiar to himself, he should set down a project of defence on paper, and have it canvassed by the most skilful officers of artillery, and engineers, about him. This must be done in private, that spies or deserters may not discover the weak parts to the enemies. In short, nothing should be neglected on the part of the governor.

He should see that the place be well supplied with plenty of ammunition, and wholesome provisions; that the hospitals are in good order, and provided with able physicians and surgeons, as likewise with every thing wholesome and necessary, that the sick and wounded may be well taken care of.

The powder-magazines, above all things, require his most special care: though they are built bomb-proof, yet, when a great number of shells fall upon them, they seldom resist their shock; for which reason they should be covered with 8 or 10 feet thick of earth, and a layer of fascines, dung and strong planks laid over them.

GRANADIER, } a foot soldier, armed with
GRENADIER, } a firelock, bayonet, and
hanger: they carry, besides their arms, a cartridge-box that will hold 24 rounds, and a pouch filled with hand-grenades. They are clothed differently from the rest of the battalion they belong to, by wearing a high cap, fronted with a plate of brass, on which the king's arms is generally represented, &c. and a piece of cloth upon their shoulders, called a wing: even in some armies they have more pay than a common soldier. They are always the tallest and briskest men, consequently the first upon all attacks. Every battalion of foot has generally a company of grenadiers belonging to it, which takes always the right of the battalion. Grenadiers were first instituted in France in 1667, by having 4 or 5 to each company; but in the year 1670, they were formed into companies, and in 1685, first known in England.

Horse-GRENADIERS, called by the French *grenadiers volans*, or flying-grenadiers, are such as are mounted on horseback, but fight both on foot and horseback. They were first established in France by Lewis XIV. in 1676, and formed into squadrons. We have in England

two troops of horse-grenadier guards, the first raised in the year 1693, and the command given to lieutenant-general Cholmondeley; the second in 1702, and the command given to lord Forbes.

GRANADES, } in the *art of war*, are hollow
GRENADES, } balls or shells, of iron or other metal, about 2½ inches diameter, which, being filled with fine powder, are set on fire, by means of a small fuze, driven into the fuze-hole, made of well-seasoned beech wood, and thrown by the grenadiers into such places where men stand thick, and particularly into the trenches and other lodgements made by the enemy. As soon as the composition within the fuze gets to the powder in the grenade, it bursts into many pieces, greatly to the damage of all who happen to be in its way. Grenades were first invented about the time shells were invented (which see) and first used in 1594. Grenades have unaccountably sunk into disuse; but I am persuaded there is nothing more proper than to have grenades to throw into the midst of the enemy, who have jumped into the ditch. During the siege of Cassel, under the Count de la Lippe, in the campaign of 1762, a young engineer undertook to carry one of the outworks, with a much smaller detachment than one which had been repulsed, and succeeded with ease, from the use of grenades; which is a proof that they should not be neglected, either in the attack or defence of posts.

GRAPE-shot. See SHOT.

GRAPPLING-irons, in the *art of war*, are composed of 4, 5, or 6 branches, bent round and pointed, with a ring at the root, to which is fastened a rope to hold by, when the grapple is thrown at any thing, in order to bring it near, so as to lay hold of it.

GROUND. See BREAK.

GROUND-work, in *military architecture*. See FOUNDATION.

GUARD, in the *military art*, is a duty performed by a body of men, to secure an army or place from being surprised by an enemy. In garrison the guards are relieved every day; hence it comes that every soldier mounts guard once every 3 or 4 days in time of peace, and much oftener in time of war. See HONOURS.

Advanced GUARD, is a party of either horse or foot, that marches before a more considerable body, to give notice of any approaching danger. These guards are either made stronger or weaker, according to the situation or danger you may apprehend from the enemy, or the country you are to march through.

Van GUARD. See ADVANCED GUARD.

Artillery GUARD, is a detachment from the army to secure the artillery when in the field. Their corps de garde is in the front of the artillery park, and their centries dispersed round the same. This is generally a 48-hours guard; and upon a march, this guard marches in the front and rear of the artillery, and must be sure to leave nothing behind: if a gun or waggon breaks down, the officer that commands the guard is to leave a sufficient number of men to assist the gunners and matrosses in getting it up again.

Artillery quarter-GUARD, is frequently a non-commissioned officer's guard from the royal regiment of artillery, whose corps de garde is always in the front of their incampment.

Artillery rear-GUARD, consists in a corporal and 6 men, posted in the rear of the park.

Corps de GARDE, are soldiers entrusted with the guard of a post, under the command of one or more officers. This word also signifies the place where the guard mounts.

Counter GUARD. See FORTIFICATION.

Grand GUARD, three or four squadrons of horse, commanded by a field-officer, posted at about a mile, or a mile and a half from the camp, on the right and left wings, towards the enemy, for the better security of the camp.

Forage GUARD, a detachment sent out to secure the foragers, who are posted at all places, where either the enemy's party may come to disturb the foragers, or where they may be spread too near the enemy, so as to be in danger of being taken. This guard consists both of horse and foot, and must remain on their posts 'till the foragers are all come off the ground.

Main GUARD, is that from whence all other guards are detached. Those who are for mounting guard assemble at their respective captain's quarters, and march from thence to the parade in good order; where, after the whole guard is drawn up, the small guards are detached to their respective posts: then the subalterns throw lots for their guards, who are all under the command of the captain of the main guard. This guard mounts in garrison at different hours, according as the governor pleases.

Piquet GUARD, a good number of horse and foot, always in readiness in case of an alarm: the horses are generally saddled all the time, and the riders booted.

The foot draw up at the head of the battalion, frequently at the beating of the tat-too; but afterwards return to their tents, where they hold themselves in readiness to march, upon

any sudden alarm. This guard is to make resistance, in case of an attack, until the army can get ready.

Baggage GUARD, is always an officer's guard, who has the care of the baggage on a march. The waggons should be numbered by companies, and follow one another regularly: vigilance and attention in the passage of hollow-ways, woods, and thickets, must be strictly observed by this guard.

Ordinary GUARDS, such as are fixed during the campaign, and relieved daily.

Extraordinary GUARDS, or detachments, which are only commanded on particular occasions; either for the further security of the camp, to cover the foragers, or for convoys, escorts, or expeditions.

Quarter GUARD, is a small guard commanded by a subaltern officer, posted in the front of each battalion, at 222 feet before the front of the regiment.

Rear GUARD, that part of the army which brings up the rear on a march, generally composed of all the old grand-guards of the camp.

The rear guard of a party is frequently 8 or 10 horse, about 500 paces behind the party. Hence the advance guard going out upon a party, form the rear guard in their retreat.

Rear GUARD, is also a corporal's guard placed in the rear of a regiment, to keep good order in that part of the camp.

Standard GUARD, a small guard under a corporal, out of each regiment of horse, who mount on foot in the front of each regiment, at the distance of 20 feet from the streets, opposite the main street.

GUARDS, also imply the troops kept to guard the king's person, and consist of both horse and foot.

Horse GUARDS, in England, are gentlemen chosen for their bravery and fidelity, to be entrusted with the guard of the King's person; and are divided into 4 troops, called the 1st, 2d, 3d, and 4th troop of horse-guards. The first troop was raised in the year 1660, and the command given to lord Gerrard; the second in 1659, and the command given to Sir Philip Howard; the third in 1665, and the command given to Earl Feversham; the fourth in 1660, and the command given to Earl Newburgh. Each troop has a colonel, 2 lieutenant-colonels, 1 cornet and major, 1 *guidon* and major, 4 exempts and captains, 4 brigadiers and lieutenants, 1 adjutant, 4 sub-brigadiers and cornets, and 60 private men.

Horse-grenadier GUARDS, are divided into 2 troops, called the 1st and 2d troops of horse-

grenadier guards. The first troop was raised in the year 1693, and the command given to lieutenant-general Cholmondeley; the second in 1702, and the command given to lord Forbes. Each troop has a colonel, lieutenant-colonel, 1 *guidon* or major, 3 exempts and captains, 3 lieutenants, 1 adjutant, 3 cornets, and 60 private men.

Yeomen of the GUARD, first raised by Henry VII. in the year 1485: they are a kind of pompous foot-guards to the king's person, and are generally called by a nick-name, the *beef-eaters*. They were anciently 250 men of the first rank under gentry, and of larger stature than ordinary, each being required to be 6 feet high. At present there are but 100 in constant duty, and 70 more not on duty; and when any one of the 100 dies, his place is supplied out of the 70. They go dressed after the manner of king Henry VIII's time. Their first commander or captain was the earl of Oxford, and their pay is 2 shillings and 6 pence per day.

Foot GUARDS, are regiments of foot appointed for the guard of his majesty, and his palace. There are 3 regiments of them, called the 1st, 2d, and 3d regiment of foot-guards. They were raised in the year 1660, and the command of the first given to colonel Ruffel, that of the second to general Monk, and the third to the earl of Linlithgow. The first regiment is at present commanded by 1 colonel, 1 lieutenant-colonel, 3 majors, 23 captains, 1 captain-lieutenant, 31 lieutenants, and 24 ensigns; and contains 3 battalions. The second regiment has 1 colonel, 1 lieutenant-colonel, 2 majors, 14 captains, 1 captain-lieutenant, 18 lieutenants, 16 ensigns; and contains only 2 battalions. The third regiment is the same as the second. The first regiment of French guards was raised in the reign of Charles IX, in the year 1563.

Trench GUARD, only mounts in the time of a siege, and consists sometimes of 3, 4 or 6 battalions, according to the importance of the siege. This guard must oppose the besieged when they sally out, protect the workmen, &c.

Provost GUARD, is always an officer's guard that attends the provost in his rounds, either to prevent desertion, maroding, rioting, &c. See PROVOST.

GUARD-Magazine. See STORE-KEEPER.

To be upon GUARD,—*To mount guard*,—*To relieve the guard*,—*The officer or serjeant of the guard*, are phrases respecting the guard, and that every one knows.

GUARD, in *fencing*, implies a posture proper to

to defend the body from the sword of the antagonist.

GUERITTE, in *ancient military history*, is a centry-box, or centinel's box. See **CENTRY-BOX**.

GUIDES, in *military affairs*, are generally the country people in the neighbourhood where the army incamps: they are to give you intelligence concerning the country, the roads by which you are to march, and the route the enemy may take to come to you. Guides should be faithful, because, in giving you false intelligence, or guiding you wrong, they may greatly endanger the army. Several guides are requisite, as every corps that marches by night should have one at least. There is sometimes a captain, or chief of the guides, who should be a man of parts, active, and attentive to the diligence and fidelity of his people. He should always have a sufficient number with him, and who are well acquainted with the country.

GUIDEFORE. See **WAGGON**.

GUIDEHIND. See **WAGGON**.

GUIDON, in *ancient military history*, the name of a sort of standard carried by the king's life-guards; so called from its being broad at one extreme, and almost pointed at the other, and slit, or divided into two.

GUIDON, also implies the officer who carries the guidon or standard.

GUN, a fire-arm, or weapon of offence, which forcibly discharges a bullet through a cylindrical barrel, by means of gun-powder. See **MUSKET**.

Evening-GUN, is generally a 12-pounder, which fires every night about sun-set, and every morning at sun-rise, to give notice to the drums and trumpets of the army, to beat and sound the retreat and the reveille.

Great GUN. See **CANNON**.

GUNNER, in the *artillery*, is the second rank of private men in the royal regiment of artillery.

Master GUNNER, one who teaches the men on ship-board to load and fire the guns: he is also a patent officer of the ordnance in garrisons.

GUNNERY, the art of determining the motions of bodies shot from cannon, mortars, howitzers, &c. See the article **PROJECTILE**.

The late ingenious Mr. Robins, having concluded from experiments, that the force of fired gun-powder, at the instant of its explosion, is the same with that of an elastic fluid of a thousand times the density of common air, and that the elasticity of this fluid, like that of the air, is proportional to its density, proposes the following problem.

The dimensions of any piece of artillery, the

weight of its ball, and the quantity of its charge being given; to determine the velocity which the shot will acquire from the explosion, supposing the elasticity or force of the powder at the first instant of its firing to be given.

In the solution of this important problem, he assumes the two following principles: 1. That the action of the powder on the shot ceases as soon as it is got out of the piece. 2. That all the powder of the charge is fired, and converting into an elastic fluid, before the shot is sensibly moved from its place.

These assumptions, and the conclusions above mentioned, make the action of fired gun-powder to be entirely similar to that of air condensed a thousand times; and from thence it will not be difficult to determine the velocity of the shot arising from the explosion: for the force of the fired powder diminishing in proportion to its expansion, and ceasing when it is got out of the piece; the total action of the powder may be represented by the area of a curve, the base of which represents the space through which the ball is accelerated, while the ordinates represent the force of the powder at every point of that space; and these ordinates being in reciprocal proportion to their distance from the breech of the gun, because when the spaces occupied by the fired powder are as 1, 2, 3, 4, &c. the ordinates representing it will be as $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \&c.$ it appears that the curve will be a common parabola, and that the area intercepted between it, its asymptote, and the two ordinates representing the force of the powder at the first explosion, and at the muzzle of the piece, will represent the total action of the powder on the shot: but if the shot were urged through the same space by an uniform force equal to its gravity, the total action of this force would be represented by a rectangle, the base of which would be the base of the curve or intercepted portion of the asymptote above mentioned, and the height of which would represent the uniform force of gravity. Hence the square of the velocity of the shot resulting from gravity is given, being the velocity it would acquire from a height equal to the space through which the powder accelerates it; and the proportion between the hyperbola and the rectangle is given from the analogy between the hyperbolic spaces and logarithms; therefore the velocity of the ball arising from the action of the fired gun-powder will be given.

Mr. Robins has also given us an ingenious way of determining, by experiments, the velocity which any shot moves with at any distance of the piece it is charged from.

This may be effected by means of a pendulum made of iron, having a broad part at bottom, covered with a thick piece of wood, which is fastened to the iron by screws; then having a machine like a common artillery-gin, on two of which poles, towards their tops, are screwed sockets, on which the pendulum is hung by means of a cross piece, which becomes its axis of suspension, and on which it should vibrate with great freedom. Something lower than the bottom of the pendulum there should be a brace, joining to which the pendulum is suspended; and to this brace there is fastened a contrivance made with two edges of steel, something in the manner of a drawing-pen; the strength with which these edges press on each other, being diminished or increased at pleasure, by means of a screw. To the bottom of the pendulum should be fastened a narrow ribbon, which, passing between the steel edges, may hang loosely down by means of an opening cut in the lower piece of steel.

The instrument being thus fitted, if the weight of the pendulum, the respective distances of its centre of gravity, and of its centre of oscillation from the axis of suspension, be known, it may from thence be found, what motion will be communicated to this pendulum by the percussion of a body of a known weight, moving with a known degree of velocity, and striking it in a given point; that is, if the pendulum be supposed to rest before the percussion, it will be known what vibration it should make in consequence of such a blow; and if the pendulum, being at rest, is struck by a body of a known weight, and the vibration which the pendulum makes after the stroke is known, the velocity of the striking body may from thence be determined.

Now, the extent of the vibration, made by the pendulum, may be increased by the ribbon: for if the pressure of the steel edges on the ribbon be regulated by the screw, so as to be free and easy, though with some minute resistance to hinder it from slipping of itself; then setting the pendulum at rest, let the part of the ribbon between the pendulum and the steel edges be drawn strait, but not strained, and fixing a pin in the part of the ribbon contiguous to the edges, the pendulum, swinging back by means of the impulse of the ball, will draw out the ribbon to the just extent of its vibration, which will be determined by the interval on the ribbon between the edges and the space of the pin.

The computation by which the velocity of the shot is determined from the vibration of the

pendulum, after the stroke, is founded on this principle of mechanics; that if a body in motion strikes another at rest, and they are not separated after the stroke, but move on with one common motion, then that common motion is equal to the motion with which the first body moved before the stroke: whence, if that common motion and the masses of the two bodies are known, the motion of the first body before the stroke is thence determined. On this principle it follows, that the velocity of a shot may be diminished in any given ratio, by its being made to impinge on a body of weight properly proportioned to it.

It is to be observed, that the length to which the ribbon is drawn, is always near the chord of the arc described by the ascent; it being so placed, as to differ insensibly from those chords which must frequently occur; and these chords are known to be in the proportion of the velocities of the pendulum acquired from the stroke. Hence it follows, that the proportion between the lengths of the ribbon, drawn out at different times, will be the same with that of the velocities of the impinging shots.

Now from the computations delivered by Mr. Robins, it appears, that the velocity of the bullet was 1641 feet in one second of time, when the chord of the arc described by the ascent of the pendulum, in consequence of the blow, was $17\frac{1}{4}$ inches, the proportion of the velocity with which the bullets impinge, to the known velocity of 1641 feet in one second, will be determined.

Mr. Robins is, I think (till of late) the only author who has attempted to ascertain the velocity of a military projectile, by experiment; yet his conclusions seem to be unsatisfactory. Perhaps he was too much attached to the forming of a system, and warped his experiments a little in favour of it. The resisting power he assigns to the air is probably too great; and his notion of the tripling of this power when the velocity of the projectile exceeds that of sound, seems to be rather an ingenious conceit than a well-grounded fact. However, experiment alone must decide these points.

Experiments to determine the projectile curve, and velocity of the curve. Plate XII. fig. 1.

1. Let there be prepared, with great accuracy, a mortar, a solid shot, and a sufficient quantity of powder, in order to preserve an uniform force as nearly as possible.

2. Chuse a convenient situation, and let

$RABCr$ be a horizontal plane, and $rab c$ the side of a hill, either regular or irregular; and from the stations R, A, B, C , let a shot or shell be projected, with the same charge and elevation, striking the side of the ascent or hill in the points r, a, b, c , respectively. At the stations A, B, C , let the angles rAa, rBb, rCc , be observed with an instrument; and also at a, b, c , observe the angles raB, rbB, rcC , which with the distances Ar, Br, Cr , will determine the amplitudes Aa, Ba, Ca : parallel to which amplitudes draw through R , the lines Rd, Re, Rf , each equal to its parallel amplitude, which will determine the points d, e, f , in the curve. And in like manner may many other points be determined.

Plate XII. fig. 2. The angle of incidence Rpt , at which the shell strikes the ground, may be determined by erecting a small stage, $abcd$, through which the shell may pass at P , and strike the ground at p ; for then the direction Pp will shew the angle of incidence Rp, Pt . In small elevations, a curtain might be placed near the extremities of the range R, r , which would determine PA , and A, R ; and pa , and ar , and consequently the angle of incidence arp . The absciss PA would shew how far the ball deviated from the curve of the parabola described on the actual range Rr . See Pl. XII. fig. 3.

Pl. XII. fig. 4. By a singular method on a descent, the continuation of the curve below

the horizon may be determined. The vertex V of the curve is always nearer to r , the extremity of the range, than to the beginning of it, R ; that is, RB is greater than Br . The vertex V must be determined by two observers with theodolites (or rather with such an instrument as Mr. Robins measured the height of the ascent of rocks with) which will determine VB, RB , and Br .

The curve from the vertex V to the horizon r , will probably coincide very nearly with a parabola, as the horizontal velocity at the vertex is never very great.

Experiments tried by the MILITARY SOCIETY at Woolwich in 1765, for the purpose of obtaining the initial velocities of shot.

These experiments were executed by a pendulum in imitation of Mr. Robins's, but greatly improved. The first was on the 13th day of May, 1775, it being a clear day; the weight of the pendulum = 328 lb. length from the axis to the ribbon = 102½ inches; from the axis to the centre of oscillation = 88 inches; from the axis to the centre of gravity = 72 inches. Distance of the pendulum from the muzzle of the gun = 29 feet. The powder was common government's powder, put into flannel cartridges, gently rammed home, and without wad.

TABLE of Experiments, 13th May, 1775.

Rounds	Weight of powder	Weight of shot	Diameter of shot	Height of charge	Struck below the axis.	To the right or left	Chord of the arc	Velocity per second
	oz.	inch.	inch.	inch.	inch.	inch.	inch.	feet
1	2	17½	1.98	—	92.5	0.8 R	13	457
2	2	17½	1.98	—	92.5	0.8 R	17.75	625
3	2	17½	1.98	3.15	91.6	0	18.1	644
4	2	17½	1.97	3.15	91	1.5 R	17.6	640
5	2	17½	1.97	3.15	90.5	0.3 R	16.3	595
6	2	17	1.96	3.1	92.4	1.8 L	16.2	588
7	4	17	1.97	4.5	92	1 L	24	863
8	4	17	1.96	4.5	90.5	0.3 R	25	927

The penetrations were neglected, as very uncertain, on account of several shot striking so near the same place. The quantity of it seemed to be about 3 inches in solid wood. The great difference between the velocity of the first shot, and all the rest, must have been owing to some unperceived accident. The mean velocity among the rest is 618 feet in a second, with 2 oz. of powder: the mean weight of the balls is 17½ inches nearly; which velocity is about

G U N


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1-6th part less than when the shot is 1-8th part heavier; owing, no doubt, to the windage attending the smaller shot. The mean between the two last with 4 oz. of powder is 895 feet, which also is proportionably less than when the

shot is larger, so as to leave no windage. Moreover, these two velocities are nearly as 1. to 1.414, the square roots of the quantities of powder.


Experiment II. 3d June, 1775. A clear day, but windy; when every thing was the same as the former day.

Rounds	Weight of powder	Weight of shot	Diameter of shot	Height of charge	Struck below the axis	To the right or left	Penetration	Chord of the arc	Velocity per second
	oz.	oz.	inches	inches	inches	inches	inches	inches	feet
1	2	19½	2.08	2.85	88½	1½ R		24½	802
2	2	19½	2.08	2.85	89	0	6½	30½	1004
3	2	19½	2.08	2.85	93½	0	5½	30	940
4	2	19½	2.08	3.35	92½	0	5½	57	755
5	2	19½	2.08	3.35	93	1 R		57	713
6	2	19½	2.08	3.3	92	½ R	5½	53	731

The first 3 rounds, the shot had no windage, consequently the velocities much greater than those of the first day's experiments. The 3 last rounds were made with long shot, whose form may be termed hemispherical-cylindrical, as they were terminated by hemispherical ends; so that their section through the axis was of this form  and the length near double of its breadth.

The 4th shot, or the first of the long kind, struck the face of the pendulum sideways, mak-

ing a hole of the shape of the above section, differing in this however, that its length or axis

was not horizontal, but vertical thus  The

5th shot struck obliquely, neither exactly with its end or side foremost. Hence all long shot have an irregular rolling motion.

The penetrations were always measured to the hinder or outward end of the shot, as it lay in the wood.

Experiment III. 12th June, 1775; clear day and calm.

Rounds	Weight of powder	Weight of shot	Height of the charge	Struck below the axis	To the right or left	Chord of the arc	Diameter of the shot	Velocity per second
	oz.	oz.	inches	inches	inches	inches	inches	feet
1	2	19½	2.85	94	0.5 R	23	2.080	700
2	2	18½	2.85	94	0.	24½	2.036	796
3	2	18½	2.85	93½	1.6 R	22	2.045	708
4	4	19	4	92½	0	27½	2.062	866
5	4	18½	4	93½	1 L	35	2.036	1141
6	4	18½	4	93½	0	33	2.045	1062

The whole weight of the pendulum = 324 lb. The mean weight of the first 3 shot is 18½ ounces, and of the latter 3 shot 18½. Also the Length to the centre of gravity = 71.4 inches. mean velocities, with 2 oz. and 4 oz. of powder, Length to the centre of oscillation = 88 inches. are 735 and 1023; which numbers are to each other as 1 to 1.4, that is, nearly as the square roots of the quantities of powder. Length from the axis to the ribbon = 102½. Distance of the gun 29 feet. Common-practice powder.

Experiment

Experiment IV. 20th July, 1775. A clear fine day.

Rounds	Weight of powder	Weight of shot	Diameter of shot	Height of the charge	Struck below the axis	To the right or left	Chord of the arc	Values of p .	Values of g .	Velocity per second
	oz.	oz.	inches	inches	inches	inches	inches	lb.	inches	feet
1	2	28½	2.021	2.85	90	1 R	14½	552	78.0000	612
2	4	28½	2.021	4.4	87	½ L	20½	553½	78.0316	883
3	8	28½	2.032	7.1	87	½ L	27½	555½	78.0632	1168
4	2	28½	2.026	2.85	90	0	15	557½	78.0948	624
5	4	28½	2.026	4.4	88	1 L	20½	559	78.1.64	874
6	8	28½	2.032	7.1	92	4½ L	28½	560½	78.1580	1158
7	2	28½	2.021	2.85	89½	1 L	14.3	562½	78.1896	608
8	4	28½	2.026	4.4	91½	1½ L	21	564½	78.2212	874
9	8	28½	2.026	7.1	87	1 L	26.8	566	78.2528	1173

Weight of the pendulum = 552 lb. = p .
Length to the centre of gravity = 78 inches = g . Length to the centre of oscillation = 88 inches = n . Length from the axis to the ribbon = 101 inches. Gun and powder the same; but the shot were of lead.

The velocities calculated in this course were corrected by the proper allowance for the increase of the weight of the pendulum, by so many heavy balls lodging in it, and which gave occasion for the 10th column, containing the several values of p , or the weight of the pendulum; the necessary allowance was also made for the alterations in the value of n , or place of the centre of oscillation, and in the centre of gravity, or value of g , as specified in the 11th column.

In the experiments of this day, the con-

clusions are very uniform and accurate; the mean velocity with 2 ounces of powder is 615 feet, with 4 ounces 877 feet, and with 8 ounces 1166 feet; which are to one another as the numbers 1, 1.426, and 1.9, that is, again, nearly as the square roots of the quantity of powder. The mean weight of the balls is 28½ ounces nearly.

Experiment V. 21st Sept. 1775, between the hours of 2 and 6; it being a fine clear afternoon, rather windy, and the morning rainy.

Weight of the pendulum = 553 lb. = p . Length to the centre of gravity = 78.125 inches = g . Length from the axis to the ribbon = 101 inches; to the centre of oscillation = 84.775 inches = n . The number of vibrations were 68 in 100 seconds. Distance of the gun = 30 feet. Powder as before.

Rounds	Powder	Shot in oz. and dr.	Weight of shot in lb.	Diameter of shot	Height of charge	Struck below axis	To the right or left	Cord of the arc	Values of p .	Values of g .	Velocity per second
	oz.	oz. dr.	lb.	inches	inches	inches	inches	inches	lb.	inches	feet
1	2	19 0	1.1875	2.062	3	88.25	0.3 L	11.35	553.00	78.125	700
2	4	19 0	1.1875	2.062	4.3	88.25	0.3 L	17.3	554.24	78.147	1070
3	8	19 0	1.1875	2.062	6.3	91.0	0	23.6	555.54	78.169	1419
4	2	19 3½	1.2012	2.070	3	90.65	1.5 R	11.35	556.80	78.196	679
5	4	19 8½	1.2208	2.081	4.3	90.65	1.5 R	17.3	558.10	78.223	1021
6	8	19 0½	1.1904	2.064	6.7	90.65	1.5 R	22.3	559.41	78.240	1353
7	2	18 15	1.1838	2.060	3	91	0.8 R	11.35	560.60	78.266	692
8	4	18 14	1.1797	2.058	4.3	90	0	15.3	561.99	78.293	943
9	8	18 9½	1.1631	2.049	6.7	90	0	22.9	563.17	78.317	1443
10	2	18 9	1.1612	2.047	3	88.25	0.5 L	10.9	564.39	78.341	704
11	4	18 4½	1.1419	2.037	4.3	88.25	2.0 R	14.8	565.57	78.361	974
12	8	18 3½	1.1396	2.036	6.7	88.25	2.0 R	20.6	566.86	78.381	1358
13	2	18 3	1.1367	2.034	3	92	1.25 R	11.35	568.00	78.401	723
14	4	18 3	1.1367	2.034	4.3	92	1.0 L	15.0	569.14	78.428	958
15	8	18 1½	1.1367	2.031	6.7	94.3	0.5 L	22.5	570.29	78.455	1412

Corrections of the variable quantities were made here very accurately, as in the last course. The weight of the wooden plugs, driven in to fill up the holes made by each shot, were also added to the pendulum.

The mean among all the velocities, with 2 ounces of powder, is 700; among those with 4 ounces, is 994; and among those with 8 ounces, is 1397: which are to one another as the 3 numbers 1, 1.42, and 2; that is, very nearly in the ratio of the square roots of the quantities of powder. Also the mean weight of the balls, is nearly 18 ounces.

Moreover, by comparing the weight and velocities of the shot in this course, with those in the course next before, it is found that the velocities, with the same quantities of powder, are very near reciprocally as the square roots of the weights of the shot.

In the first place it may be observed, that the increase of velocity is very considerable by diminishing the windage, in so much that of shells or round shot, fired out of artillery, with the same quantity of powder, the larger shot has always a much greater velocity than the less one has; so that, by diminishing the windage, the momentum or force of the shot is much increased, as well by the increase of the velocity, as of the weight of the shot: and as it is the opinion of the founders of shot and cannon, that they can now work much truer than at the time when the present windage was first settled; it therefore seems, that the shot might (without any inconvenience) be so much increased, and the windage thereby decreased, that $\frac{1}{2}$ or $\frac{2}{3}$ of the present usual quantity may produce as great an effect as the whole does now: hence $\frac{1}{2}$ or $\frac{2}{3}$ of the powder may be saved.

That increasing the quantity of the charge does not increase the velocity, so much as at first sight might be expected, and the range still less; for a double charge gives but between $\frac{1}{2}$ and 1-3d more velocity, and the range will be scarcely 1-4th or 1-5th more.

By comparing together the effects of shot of different weights, it appears, that by increasing or diminishing the weight of the shot (still retaining the same diameter) does not alter the velocity proportionally; but only in such proportion as the alteration just mentioned with regard to the quantity of powder; that is, a shot of double weight will move with a velocity but about 1-3d less than before; but its range will not be so much diminished, because its greater weight will better overcome the resistance of the air. Hence, leaden shot will range as far, or farther, than iron shot: and

therefore, if a hard and cheap metal could be obtained, as heavy as lead, it would be a great improvement in artillery. But such improvement may also be effected by making hemispherical-cylindrical shot, as used in the second experiment, as it from thence appears, that by lengthening the shot, and rounding its ends, it may be increased to double or triple the weight, without losing any of the velocity, when the windage is sufficiently diminished. Shot of this kind would therefore be a very great improvement in artillery, for both land and sea service; for by this means, small and light cannon may be made to throw shot of twice, thrice, or four times the weight of their proper round shot; thus be made to answer the end of the very heaviest battering cannon; which will be a prodigious saving (besides that of the powder) in the value or casting of the guns, and making of the carriages, and likewise in the expence and trouble of conveying them with an army, or by sea. Besides, there is another advantage attending these shot for the sea service, which is, that they will do much more damage to ships, by rending and splintering them more than round shot can do, if these were even as heavy as the long ones. See PROJECTILES.

GUN-POWDER, a composition of saltpetre, sulphur, and charcoal, well mixed together and granulated, which easily takes fire, and expands with amazing force.

Invention of GUNPOWDER, is usually ascribed to one Bartholdus Schwartz, a German monk, who discovered it about the year 1320; and the first use of it in war is commonly supposed to have been by the Venetians against the Genoese in the year 1380. Thevel says its inventor was one Constantine Anelzen, a monk of Friburg. Peter Mexia says it was first used by Alphonfus XI. king of Castile, in the year 1342. Ducange adds, that there is mention made of this powder in the registers of the chambers of accounts of France, so early as the year 1338; and our countryman, Friar Bacon, expressly mentions the composition in his treatise *De nullitate Magiæ*, published at Oxford in the year 1216. Some indeed are of opinion that the Arabians, or the latter Greeks, were the first inventors of gunpowder, about the middle ages of our æra; because its Arabic name is said to be expressive of its explosive quality.

Method of making GUN-POWDER. Take saltpetre, sulphur, and charcoal; reduce these to a fine powder, and continue beating them for some time in a stone mortar, with a wooden pestle,

pebble, wetting the mixture between whiles with water, so as to form the whole into an uniform paste, which is afterwards reduced to grains, by passing it through a white sieve for the purpose; and in this form, being carefully dried, it becomes the common gun-powder. For greater quantities, mills are used, by means of which more work may be performed in one day, than a man can do in a hundred. See MILL.

How to refine salt-petre. Put into a copper, or any other vessel, 100 weight of rough nitre, with about 14 gallons of clean water, and let it boil gently for $\frac{1}{2}$ an hour, and as it boils take off the scum; then stir it about in the copper, and before it settles put it into your filtering-bags, which must be hung on a rack, with glazed earthen pans under them, in which must be sticks laid across for the crystals to adhere to: it must stand in the pans for 2 or 3 days to shoot; then take out the crystals and let them dry. The water that remains in the pans, boil again for an hour, and strain it into the pans as before, and the salt-petre will be quite clear and transparent; if not, it wants more refining; to do which proceed as usual, 'till it is well cleansed of all its earthy parts.

How to pulverise salt-petre. Take a copper kettle, whose bottom must be spherical, and put into it 14 lb. of refined salt-petre, with 2 quarts or 5 pints of clean water; then put the kettle on a slow fire; and when the salt-petre is dissolved, if any impurities arise, skim them off, and keep constantly stirring it with 2 large spatulas, 'till all the water exhales; and when done enough, it will appear like white sand, and as fine as flour: but if it should boil too fast, take the kettle off the fire, and set it on some wet sand, which will prevent the nitre from sticking to the kettle. When you have pulverised a quantity of salt-petre, be careful to keep it in a dry place.

Different kinds of GUN-POWDER. It being proper that every one who makes use of powder, should know of what it is composed, &c. Gun-powder, for some time after the invention of artillery, was of a composition much weaker than what we now use, or than that ancient one mentioned by Marcus Græcus: but this, I presume, was owing to the weakness of their first pieces, rather than to their ignorance of a better mixture; for the first pieces of artillery were of a very clumsy, inconvenient make,

being usually framed of several pieces of iron bars, fitted together lengthways, and then hooped together with iron rings; and as they were first employed in throwing stone shot of a prodigious weight, in imitation of the ancient machines, to which they succeeded; they were of an enormous bore. When Mahomet II. besieged Constantinople in the year 1453, he battered the walls with stone bullets, and his pieces were some of them of the calibre of 1200 lb.; but they could not be fired more than 4 times in the 24 hours, and sometimes they burst by the first discharge. Powder at first was not grained, but in the form of fine meal, such as it was reduced to by grinding the materials together; and it is doubtful, whether the first graining of it was intended to increase its strength, or only to render it more convenient for the filling it into small charges, and the loading of small-arms, to which alone it was applied for many years, whilst meal-powder was still made use of in cannon. But at last the additional strength which the grained powder was found to acquire from the free passage of the fire between the grains, occasioned the meal powder to be entirely laid aside. The coal for making gun-powder, is either that of willow or hazle; but the lightest kind of willow is found to be the best, well charred in the usual manner, and reduced to powder. Corned powder was in use in Germany as early as the year 1568; but first generally used in England in the reign of Charles I.

Government-Powder, } such powder as, hav-
Ordnance-Powder, } ing undergone the
customary proof established by the board of ordnance, is received into the king's magazines.

Proof of GUN-POWDER, as practised by the board of ordnance. They first take out of the several barrels of gun-powder, a measure full, of about the size of a thimble, which is spread upon a sheet of fine writing-paper, and then fired: if the inflammation is exceeding rapid, the smoke rises perpendicular, and the paper is neither burnt nor spotted, it is judged to be good powder.

Then 2 drams of the same powder is exactly weighed, and put into an eprouvette; which, if it raises a weight of 24 pounds to the height of $3\frac{1}{2}$ inches, it is received into the king's magazines.

GUN-POWDER Prover. See EPROUVETTE.

H

HABERGEON, in *military antiquity*, was a small coat of mail, or only sleeves and gorget of mail, formed of little iron rings, or meshes linked into each other. See **GORGET**.

HABILIMENTS of war, in our *ancient statutes*, signify armour, harness, utensils, or other provisions for war, without which there is supposed no ability to maintain a war.

HALBARD, } in the *art of war*, a well-known weapon, carried by the serjeants of foot, and artillery. It is a sort

HALBERT, } of spear, the shaft of which is about 5 feet long, made of ash, or other wood. Its head is armed with a steel point, edged on both sides. Besides this sharp point, which is in a line with the shaft, there is a cross piece of iron, flat and turned down at one end, but not very sharp; so that it serves equally to cut down, or push withal. It is more for show than use.

The halbard is a very ancient weapon, being made use of by the Amazons, and afterwards by the Rhetians and Vindelicians about the year 570.

HALF-Files. See **FILES**.

HALF-Moon, or *demi-lune*. See **FORTIFICATION**.

HALT, is to discontinue the march of troops, to stand still, to stop in order to rest or perform any other motion; hence the word of command for troops to stop is, **HALT**.

HAIR-Cloth, used on the floor of powder magazines, and laboratories, to prevent accidents of fire from men's shoes treading or rubbing upon nails, sand, or gravel, and so striking fire.

HAND-Barrow, is made of light wood, and is of great use in fortification, for carrying earth from one place to another; or, in a siege, for carrying shells or shot along the trenches.

HAND-Grenades, are small iron shells from 2.5 to 3 inches diameter, filled with powder, which being lighted by means of a fuze, are thrown by the grenadiers amongst the enemy on sundry occasions.

HAND-Screws, are composed of a toothed iron bar, that has a claw at the lower end, and a fork at the upper; this bar is fixed in a stock of wood about 2.5 feet high, and 6 inches thick, moved by a rack-work; so that this

claw or fork, being placed under a weight, raises it as far as the bar can go.

HAND-Spikes, in *gunnery*, are wooden levers 5 or 6 feet long, flattened at the lower end, and tapering towards the other; useful in moving guns to their places, after being fired and loaded again.

HAND-Mallets, are wooden hammers, with a handle, to drive fuzes and pickets, in making fascine or gabion batteries, &c.

HASP, a flat staple to catch the bolt of a lock. See **CARRIAGE**.

HATCHET, used in the army, a small light sort of an ax, with a basil edge on the left side, and a short handle; used by the men for cutting wood to make fascines, gabions, pickets, &c.

HAVERSACK, in a *military sense*, is a kind of bag, made of strong coarse grey linen, to carry bread and provisions on a march. They are only used in the field, and in cantonments, each soldier having one.

HEAD, in *gunnery*, the fore part of the cheeks of a gun or howitz carriage.

HEAD of a work, in *fortification*, is the front next to the enemy, and farthest from the place; as the front of a horn-work is the distance between the flanked angles of the demi-bastions: the head of a double tenaille is the salient angle in the centre, and the two other sides which form the re-entering angles. See **FORT**.

HEAD of an army, is the front, whether drawn up in lines, or on a march.

HEAD of a double tenaille, the salient angle in the centre, and the two other sides which form the re-entering angle.

HEAD-Piece, armour for the head, an helmet, such as the light dragoons wear.

HEAD of a camp, the ground before which the army is drawn up.

HELEPOLIS, in the *ancient art of war*, a machine for battering down the walls of a place besieged: the invention of it is ascribed to Demetrius the Poliorcete. Diodorus Siculus says, that each side of the *helepolis* was 450 cubits broad, and 90 in height; that it had 9 stages, and was carried on 4 strong solid wheels, 8 cubits in diameter; that it was armed with huge battering-rams, and had 2 roofs capable of supporting them; that in the lower

lower stages there were different sorts of engines for casting stones; and in the middle they had large catapults for lancing arrows, with a number of expert men for working all these machines.

HELMET, an ancient defensive armour, worn by the horsemen, both in war and tournaments. It covered both the head and face, only leaving an aperture in the front, secured by bars, which was called the visor. The Carians first invented the boss of shields and the crest of helmets. In remembrance of this, a small shield and a crest were always buried with them. It is now entirely in disuse.

HELVES, or *Hafts*, the wooden handles of hatchets, hammers, or pick-axes, &c.

HEMERODROMI, in the *ancient art of war*, were a kind of centinels or guards appointed for the security and preservation of cities and other places.

HEXDECAGON, a figure that has 16 sides, and as many angles, each capable of a regular baltion.

HEPTAGON, a figure consisting of 7 sides, and as many angles. If the sides be all equal, it is called a regular *heptagon*, &c.

HEPTAGONAL numbers, are a sort of polygonal numbers, wherein the difference of the terms of the corresponding arithmetical progression is = 5. One of the properties of these numbers is, that if they be multiplied by 40, and 9 be added to the product, the sum is a square number.

HERALD, an officer at arms, whose business it is to declare war, to proclaim peace, to marshal all the solemnities at the coronation, christening, marriage, and funeral, of princes and great generals.

HERRISON, in *fortification*, a beam or barrier made of one strong piece of wood, full of iron spikes. It is generally supported in the middle, and turns upon a pivot or axis. Its use is to stop up any passage, though frequently placed before the gates, and more especially the wicket-doors of a town or fortrefs; to secure those passages, which must of necessity be often opened and shut.

HERO, in a *military sense*, is a great, illustrious, and extraordinary personage; particularly in respect of valour, courage, intrepidity, and other military virtues. Modern authors make a distinction between a hero, and a great man; that the former is more daring, fierce, and enterprising; and the latter more prudent, thoughtful, and reserved. In this sense we say, Alexander was a hero, and Julius Cæsar a great man.

HERSE, in *fortification*, strong pieces of wood jointed cross-ways, like a lattice or harrow, and stuck full of iron spikes. It is usually hung by a rope, fastened to a molinet, which is cut in case of a surprise, or when the first gate is forced by surprise, or with a petard, to the end that it may fall and stop the passage of the gate, or other entrance of a fortrefs.

These *herfes* are also often laid in the roads, with the points upwards, instead of the chevaux-de-frize, to incommode the march of both horse and foot. Common harrows are sometimes made use of in case of haste, and turned with their points upwards.

HERSILLON, in the *military art*, is for the same use as the herse, and is made of one strong beam, about 10 or 12 feet long, whose two sides are stuck full of spikes, to incommode both horse and foot. The word is a diminutive of the preceding.

HEXÆDRON, one of the platonic, or 5 regular bodies, being a solid consisting of 6 equal sides or faces, popularly called a cube.

HEXAGON, is a figure of 6 sides, and as many angles, capable of being fortified with 6 baltions. If the sides and angles be equal, it is called a regular hexagon. The side of a regular hexagon inscribed in a circle, is equal to the radius of that circle; hence a regular hexagon is inscribed in a circle, by setting the radius of 6 times upon the periphery: as 1 to 1.672, so is the square of the side of any regular hexagon to the area thereof nearly.

Tanned HIDES, are always carried along with an army, especially in the laboratory's stores, to protect powder or shells from rain: they are also used upon batteries, and in laboratories.

HINGES, are two iron bands, with a joint nailed to the doors or lockers of gun-carriages to fasten them, and move them backwards and forwards.

HISTORY, a narration or description of the several transactions, actions, or events of a state, king, or private person, in the order in which they happened.

Military HISTORY, a faithful narrative of military transactions, campaigns, battles, sieges, marches, &c. of an army: likewise a relation of the heroic actions of great generals, &c.

HOBITS. See *Howitz*.

HOLLOW-Square, a body of foot drawn up with an empty space in the middle, for the colours, drums, and baggage, &c. See *Square*.

Hollow-Tower, is a rounding made of the remainder of 2 brisures, to join the curtain to the orillon, where the small shot are played, that

that they may not be so much exposed to the view of the enemy.

Order of the Holy-Ghost, the principal military order in France, instituted by Henry III. in 1569. It consists of 100 knights, who are to make proof of their nobility for three descents. The king is the grand master, or sovereign, and as such, takes an oath, on his coronation-day, to maintain the dignity of the order. The knights wear a golden cross, hung about their necks by a blue silk ribband, or collar: but before they receive this order, of the Holy-Ghost, that of St. Michael is conferred, as a necessary degree; and for this reason their arms are surrounded with a double collar.

HONEY-Combs, in *cannon*, flaws in the metal, a fault in casting, and dangerous in firing. The board of ordnance rejects all guns (on proof) having an honey-comb of $\frac{1}{10}$ of an inch deep, as being unfit for service.

HONOUR, in a *military sense*, is a vague expression, to which custom has given different meanings. Honour consists in the constant practice of virtue. Aristotle calls it the recompence of virtue; the testimony of the excellence of a man who distinguishes himself by virtue. An Italian writer calls it a state of inviolable dignity, above all calumny, and all suspicion. Honour gives many advantages; it procures us the consideration of the public; it gives weight to our actions; it advances our fortunes. The best recompence of a brave action is, undoubtedly, the satisfaction of having done it; but nevertheless the honour resulting to us from it is a real good, which should be dear to us.

Military Honours. All armies salute crowned heads in the most respectful manner, drums beating a march, colours and standards dropping, and officers saluting. Their guards pay no compliment, except to the princes of the blood; and even that by courtesy, in the absence of the crowned head.

To the commander in chief the whole line turns out without arms, and the camp-guards beat a march, and salute.

To generals of horse or foot, beat a march and salute.

Lieutenant-generals of ditto, three ruffs, and salute.

Major-generals of ditto, two ruffs, and salute.

Brigadiers of ditto, rested arms, one ruff, and salute.

Colonels of ditto, rested arms, and no beating. Centinels rest their arms to all field-officers, and shoulder to every officer.

All governors, that are not general-officers, shall, in all places where they are governors, have one ruff, with rested arms; but for those who have no commission as governors, no drum shall beat.

Lieutenant-governors shall have the main-guard turned out to them with shouldered arms.

Prussian Honours of war, chiefly imitated by most powers in Europe, are,

To the king all guards beat the march, and all officers salute.

Field-marsbals received with the march, and saluted in the king's absence.

Generals of horse or foot, four ruffs; but if he commands in chief, a march and salute.

Lieutenant-generals of horse or foot, (commanding or not) guards beat three ruffs.

Major-generals of horse or foot, two ruffs.

Officers, when their guards are under arms, and a general makes a signal, must rest to him, but not beat; when not got under arms, and a signal made, only stand by their arms.

Village-guards go under arms only to the king, field-marsbals, generals of horse and foot, and to the general of the day.

Generals guards go under arms only to the king, field-marsbals, and the general over whom they mount.

Commanding officers of regiments, and battalions, their own quarter and rear guards to turn out; but not to other field-officers, unless they are of the day.

Generals in foreign service, the same.

Honours paid by centinels.

Field-marsbals, two centinels with ordered firelocks, at their tent or quarters.

Generals of horse or foot, two centinels, one with his firelock shouldered, the other ordered.

Lieutenant-generals, one, with firelock ordered.

Major-generals, one, with firelock shouldered.

The first battalion of guards go under arms to the king only; not to stand by, nor draw up in the rear of their arms to any other; nor to give centinels to foreigners. Second and third battalions draw up behind their arms to the princes, and to field-marsbals; but when on grenadier-guards, or out-posts, they turn out, as other guards do, to the officers of the day. They give one centinel with shouldered arms to the princes of the blood, and to field-marsbals, when they lie alone in garrison.

Guards on Honour in Prussia.

The king, what he pleases.

Field:

H O N

Field-marshal and commander in chief, 1 lieutenant, 2 non-commissioned officers, and 40 men, to guard his baggage, &c. If the king is present, but 1 lieutenant, 1 non-commissioned officer, and 20 men.

General of foot, 1 ensign, 1 non-commissioned officer, and 15 men; but when he commands a detachment, 1 lieutenant, and 30 men.

Lieutenant-general, 1 non-commissioned officer, and 15 men. Ditto on detachments, 1 ensign, and 20 men.

Major-general, 1 non-commissioned officer, and 12 men.

Grand-magazine-guard depends on the greater or less quantity of provisions.

Surgeon's chest, and solicitor-general's, remain in the nearest covered town.

Provost-general's guard depends on the number of his prisoners.

Artillery provide their own guard.

Lieutenant and major-general's guard, from their brigades.

H O S

Field-marshals and generals of foot, by their own regiments.

Generals guards formed by the eldest adjutants, after the quarter-guards are mounted, &c.

Generals guards to have pickets on the right of their tents.

HONOURS paid to the King, &c. by garrisons in Prussia.

When they permit, to fire a triple discharge of all the cannon, half-loaded.

Field-marshal, single discharge of 9 cannon, with half-loading; guards to beat a march, and officers salute.

Guards pay the same compliments to general officers in garrison as in camp.

Colonel, when commandant; all guards rest their arms, and port-guards shoulder their arms. Other guards rest. Centinels rest their arms to all field-officers.

HONOURS by GUARDS, as a compliment to general officers, &c. with the detail of officers and men they are entitled to in the English army.

GUARDS	Captains	Lieutenants	Ensigns	Serjeants	Drummers	Fifers	Private men
The general in chief has - -	1	1	1	2	2	2	50
General of horse and foot - -	1	1	1	2	2	2	50
Lieut. gen. of horse and foot -		1		1	1	1	30
Major-general of horse and foot -			1	1	1	1	20
Brigadier - - - -				1			12
Quarter-master-general - -				1			12
Majors of brigade, incamped } together - - - -				1			2
Judge advocate - - - -				1			7
Provost-marshal - - - -				1			18
Provost-marshal, when he has } prisoners - - - -		1		2	1	1	48

HOOKS, those which are fixed to the transom plates of a field-carriage: they serve to fix the drag-ropes for drawing it occasionally backwards and forwards.

HOOPS, of iron, of several sorts, such as nave and axle-tree hoops.

HORIZONTAL Superficies, is the plain field lying upon a level, without any rising or falling.

HORIZONTAL Range. See **RANGE**.

HORN-Work. See **FORTIFICATION**.

HORSE-Shoe. See **FORTIFICATION**.

HORSE, in a military sense. } See **CAVALRY**.
A body of HORSE. - - - }

HOSPITAL, a place appointed for the sick and wounded men, provided with a number of physicians, surgeons, nurses, servants, medicines, beds, &c.

Camp

Camp-HOSPITALS, are either general or regimental. The general hospitals are of two kinds, viz.

Flying-HOSPITAL. } The first attends the
Stationary-HOSPITAL. } camp at some convenient distance, and the latter is fixed at one place. In the choice of both Dr. Pringle thinks it better to have them in towns than villages, as the former will afford larger wards, besides more of other conveniences. Their wards should be as airy as possible.

Regimental-HOSPITALS, are frequently in barns, stables, granaries, and other out-houses; but above all, churches make the best hospitals from the beginning of June to October: these hospitals are solely for the use of the regiment they belong to.

HOSPITAL-Fever, a name given to the malignant catarrhal fever, as being most frequent in hospitals.

HOSTAGE, a person given up to an enemy as a security for the performance of the articles of a treaty.

HOSTILITY, denotes a state of war or enmity between two nations. During a truce all acts of hostility are to cease on both sides.

HOUSING, or saddle-housing, cloth, skin, or other ornament added to saddles, by way of distinction; frequently embroidered with gold or silver, or edged with gold or silver lace.

HOWITZ, a kind of mortar, mounted upon a field-carriage like a gun: the difference between a mortar and a howitz is, that the trunnions of the first are at the end, and in the middle in the last. The invention of howitzes is of much later date than mortars, for they really had their origin from them.

The constructions of howitzes are as various and uncertain as those of mortars, excepting the chambers, which are all cylindric. They are distinguished by the diameter of the bore; for instance, a 10-inch howitz is that, the diameter of which is 10 inches; and so of the smaller ones.

Dimensions of Howitzes. Plate XIII. fig. 6.

	Inch.	Inch.
Diameter of the bore	—	10. | 8.
From the muzzle to the reinforce	19.4	16.
Length of the reinforce	—	11.9 | 10.7
Total length of the howitz	50.4	37.4
Length of the { bore	29.2	25.9
{ chamber	16.8	9.9
Its greatest } diameter	{ 6.5	4.6
Its least } diameter	{ 5.6	4.
Breadth of the muzzle-ring	1.7	1.25

	Inch.	Inch.
From the muzzle-ring to the astragal	4.3	4.6
Breadth of the astragal	—	1.3 | .7
Of the ogee { before } the rein- }	2.	1.4
{ behind } force }	1.7	0
Of the astragal	—	1.4 | .7
Of the base ring	—	1.8 | 1.25
From the base-ring to the astragal	2.2	0
Breadth of the astragal	1.3	0
Thickness of the metal at the muz.	2.75	2.25
At the muzzle-ring	—	5. | 3.4
Near the reinforce	—	3.4 | 2.6
At the reinforce	—	5.0 | 3.4
Behind the reinforce	—	4.4 | 2.5
Diameter of the	base ring	20. | 14.7
	vent astragal	17.5 | 12.5
	cable	8.25 | 7.6
	button	7. | 3.
	neck	5. | 3.5
Breadth of the ogee and fillets	1.	.9
Of the second ogee and fillets	1.6	.9
Diameter of the	first fillet	11.13 | 9.5
	second	7.64 | 4.5
Length and diameter of the trunnion	6.	4.4
From the reinforce to the trunnion	2.	1.2
Chamber contains powder lb.	18	1b. 4
Weight of the howitz	C. 31 2 26	112 1 11

Howitz-Carriage. See CARRIAGE.

HUNTERS. See HORSE.

HURDLES, in fortification, are made of twigs of willows or osiers, interwoven close together, sustained by long stakes. They are made in the figure of a long square; the length being 5 or 6 feet, and breadth 3 or 3½. The closer they are wattled together, the better. They serve to render batteries firm, or to consolidate the passage over muddy ditches; or to cover traverses and lodgements for the defence of the workmen against the fire-works, or the stones, that may be thrown against them.

HURTERS, a flatted iron fixed against the body of an axle-tree, with straps to take off the friction of the naves of wheels against the body.

HURTER. See BATTERY.

HUSSARS, are the national cavalry of Hungary and Croatia. Their regimentals consist in a rough furred cap, adorned with a cock's feather (the officers, either an eagle's or a heron's), a doublet, with a pair of breeches, to which the stockings are fastened, and yellow or red boots; besides they occasionally wear a short upper waistcoat, edged with furs, and 5 rows of round metal buttons, and in bad weather a cloak. Their arms are, a sabre, carbine, and pistols. They are irregular troops: hence, before

before beginning an attack, they lay themselves so flat on the necks of their horses, that it is hardly possible to discover their force; but being come within pistol-shot of the enemy, they raise themselves with such surprising quickness, and begin the fight with such vivacity on every side, that unless the enemy is accustomed to their method of engaging, it is very difficult for troops to preserve their order. When a retreat is necessary, their horses have so much fire, and are so indefatigable, their equipage so light,

and themselves such excellent horsemen, that no other cavalry can pretend to follow them: they leap over ditches, and swim over rivers, with surprising facility. They never incamp, consequently are not burthened with any kind of camp-equipage, saving a kettle and a hatchet to every 6 men. They always lie in the woods, out-houses, or villages, in the front of the army. The Emperor, queen of Hungary, and the king of Prussia, have the most troops under this name in their service.

J I

JACK. See **GIN**.

JAMES, or *Knights of St. James*, a military order in Spain, first instituted in the year 1170, by Ferdinand II. king of Leon and Galicia. The greatest dignity belonging to this order is grand-master, which has been united to the crown of Spain. The knights are obliged to make proof of their descent from families that have been noble for 4 generations, on both sides: they must also make it appear that their said ancestors have neither been Jews, Saracens, nor heretics; nor have ever been called in question by the Inquisition. The novices are obliged to serve 6 months in the galleys, and to live a month in a monastery. They observe the rules of St. Austin, making no vows but of poverty, obedience, and conjugal fidelity.

JANIZARIES, an order of the Turkish infantry, reputed the Grand Signior's guards, and the main strength of the Ottoman army: they are all infantry, and were first formed of captive Christians by the emperor Amurath I. Their number is generally above 40,000, divided into 162 companies, or chambers, called *odas*, in which they live together at Constantinople, as in a convent. The Janizaries are of a superior rank to all other soldiers: they are also more arrogant and factious; and it is by them the public tranquillity is mostly disturbed. The government may therefore be said to be entirely in the hands of Janizaries. They have however some good qualities: they are employed to escort travellers, and especially ambassadors, and persons of high rank, on the road; in which case they behave with the utmost zeal and fidelity.

JAVELIN, in *military antiquity*, a sort of

spear $5\frac{1}{2}$ feet long; the shaft of which was of wood, with a steel point. Every soldier in the Roman armies had 7 of these, which were very light and slender.

ICHOGRAPHY, in *fortification*, denotes the plan or representation of the length and breadth of a fortification, the distinct parts of which are marked out, either on the ground itself, or on paper: by this we are at once acquainted with the value of the different lines and angles.

IMPETUS, in *mechanics*, the force with which one body impels or strikes another. See **GUNNERY**, **MOMENTUM**.

INCH, a well-known measure in length, being the 12th part of a foot, and equal to 3 barley-corns in length. See **MEASURE**.

INCLINED Plane. See **GUNNERY**.

INCAMPMENT, the lodging of an army in the field, according to its several quarters, which are to lie conveniently for water, wood, and forage, &c. See **CAMP**.

INCAMP. *To incamp*, is the pitching of tents, when the army after a march is arrived at a place where it is designed to halt a night, or longer. See **CAMP**.

INDENTED Line, in *fortification*, is a line running out and in, like the teeth of a saw, forming several angles; so that one side defends another. They are used on the banks of rivers, where they enter a town; likewise the parapet of the covert-way is often indented. This is by the French engineers called *Redans*. Small places are sometimes fortified with such a line; but the fault of such fortifications is, that the besiegers from one battery may ruin both sides of the tenaille of the front of a place, and make

I N D

an assault, without fear of being enfiladed, since the defences are ruined.

INDEPENDENT Company, } is what is not
INDEPENDENT Troop, } incorporated
into any regiment.

INFANTRY, means the whole body of foot soldiers, whether independent companies, or regiments. The origin of the word is taken from one of the *Infantas* of Spain, who, finding that the army commanded by the king her father, had been defeated by the Moors, assembled a body of foot soldiers, and with them engaged and totally routed the enemy. In honour of this event, and to distinguish the foot soldiers, who were not before held in much consideration, they received the name of infantry.

Heavy-armed **INFANTRY**, amongst *the ancients*, were such as wore a complete suit of armour, and engaged with broad shields and long spears. They were the flower and strength of the Grecian armies, and had the highest rank of military honour.

Light-armed **INFANTRY**, amongst *the ancients*, were designed for skirmishes, and for fighting at a distance. Their weapons were arrows, darts, or slings.

Light-Infantry have only been in use since the year 1656. They have no camp-equipage to carry, and their arms and accoutrements are much lighter than the infantry. Among the troops of this country is not found any light infantry, though they are the eyes of a general, and the givers of sleep and safety to an army. Wherever there is found light-cavalry, there should be light-infantry. They should be accustomed to the pace of 4 miles an hour, as their usual marching pace, and to be able to march at 5 miles an hour, upon all particular occasions. Most of the powers on the continent have light-infantry.

INFIRMARY. See **HOSPITAL.**

ENGINEER. See **ENGINEER.**

INSCONSED, in the *military art*. Part of an army that have fortified themselves with a sconce or small work, in order to defend some pass, &c. are said to be *inconsed*.

K E T

INSULT, in the *art of war*. See **ASSAULT.**

INTERIOR *side of a fortification*, is an imaginary line drawn from the centre of one bastion to that of the next; or rather the curtain produced to the centres of the bastions.

INTERVALS, in the *art of war*, the spaces left between each regiment in camp, as likewise between each tent. See **CAMP.**

Intervals, though they never exceed the length of a battalion or squadron, are sometimes less, according to the views of a commander; so that there is no general rule in forming them.

INTRENCHMENT, any work that fortifies a post against an enemy that attacks. It is generally taken for a ditch or trench with a parapet. *Intrenchments* are sometimes made of fascines, with earth thrown over them, of gabions, hogheads, or bags filled with earth, to cover the men from the enemy's fire. See **RETRENCHMENT.**

INVALID, is a soldier who has spent his time in war, and the army; and is, either through age, or by reason of his wounds, rendered incapable of the service. We have 20 independent companies of invalids, dispersed in the several forts and garrisons; and those that are incapable of any service, are disposed of in hospitals.

INVASION, in *war*, the entrance or attack of an enemy on the dominions of another.

JOINT-Bolts. See **BOLTS.**

IRON-Guns. See **GUNS.**

IRON, for marking with a broad R the horses that are taken for the government's service to draw the artillery, ammunition, and stores, &c.

IRONS. See **PRIMING-IRONS.**

INVESTING *a place*, is when a general, having an intention to besiege it, detaches a body of horse to possess all the avenues; blocking up the garrison, and preventing relief from getting into the place, 'till the army and artillery are got up to form the siege.

JUST, a sportive combat on horseback, man against man, armed with lances.

K

KEEP, in *ancient military history*, a kind of strong tower in the middle of a castle or fort, wherein the besieged made their last efforts of defence.

KETTLE, to boil composition for fireworks.

KETTLE-Drums. See **DRUMS.**

KETTLE-Drum-Cart, belonging to the royal artillery

artillery only, is a four-wheel carriage, drawn by 4 horses. On the fore part stands the ordnance-flag, and on the hind sits the drum-major, with 2 kettle-drums, as in a chair of state. This cart is finely engraven and gilt. It has not been in the field since the year 1743, when his majesty was present. It is kept in the tower.

KEYS, in *artillery carriages*, are of different sorts:

Fore-lock-KEYS, serve to pass through the lower end of bolts, to fasten them.

Spring-KEYS, serve the same purposes as the other; but, instead of being of one single piece, they are of two, like two springs laid one over the other: when they are put into eye-bolts, they are pinched together at the ends, and when they are in, open again: hence they cannot shake out by the motion of the carriages. They are used in travelling-carriages.

KEYS, with chains and staples fixed on the side-pieces of a carriage or mortar-bed: they

serve to fasten the cap-squares, by passing through the eyes of the eye-bolts.

KLINKETS, in *fortification*, are a sort of small gates made through pallisades, for sallies.

KNAPSACK, in a *military sense*, a rough leather-bag, which a soldier carries on his back, and which contains all his necessaries. Square knapsacks are most convenient, and should be made with a division to hold the shoes, black-ball and brushes, separate from the linen. White goat-skins are the best.

KNIGHT, a person who, on account of some martial feat, or notable action, is by the king raised to a rank above a gentleman. The original German and Dutch word *knacht*, or *knecht*, signifies a servant, as we find it still meant by the knight of the shire; and afterwards it denoted a military man, or rather horseman, as being usually employed on horseback. In our common law they are called *milites*, as commonly holding lands by knights service, to serve the king in his wars.

L

LABARUM, in the *ancient art of war*, the standard born before the Roman emperors; being a rich purple streamer, supported by a spear.

LABORATORY, signifies that place where all sorts of fire-works are prepared, both for actual service, and for pleasure, viz. quick-matches, fuzes, portfires, grape-shot, case-shot, carcasses, hand-grenades, cartridges, shells filled, and fuzes fixed, wads, &c. &c.

Agrette. See MORTARS.

Balls are of various sorts, shapes and forms; as

Chain-shot, in *military matters*, are two shot linked together by a strong chain of 8 or 10 inches long: they are more used on board men of war, than in the land service. The famous M. de Witt was the first inventor, about the year 1665.

Light-balls, of which there are several sorts: the best composition is mealed powder 2, sulphur 1, rosin 1, turpentine 2½, and saltpetre 1½. Then take tow, and mix and dip it in this composition, 'till of a proper size, letting the last coat be of mealed powder. Or take thick strong paper, and make a shell the size of the

mortar you intend to throw it out of, and fill it with a composition of an equal quantity of sulphur, pitch, rosin, and mealed powder; which being well mixed, and put in warm, will give a clear fire, and burn a considerable time.

When they are intended to set fire to magazines, &c. make them as follows, viz. *Pl. XII. fig. 9*. Set off with a radius of ¼ the calibre of the mortar, the circle *ABCD*, dividing the same into 4 equal parts: out of *B*, and with the radius *AB*, describe the arc *AE*; and from *A*, with the radius *AB*, describe the arc *BE*; and from *E*, with the radius *EA*, the arc *AB*: now 8 such pieces, as *ABE*, cut out of dimitty, &c. and sewed together, will make, when filled, a ball exactly round. N. B. A small hole must be left to fill them by. The composition for filling them is, mealed powder 10, saltpetre 2, sulphur 4, and rosin 1; or mealed powder 4, pounded glass 1, antimony ½, camphire ½, sal-ammoniac 1, common salt ¼; or mealed powder 48, saltpetre 32, sulphur 16, rosin 4, steel or iron filings 2, fir-tree saw-dust boiled in saltpetre lye 2, and birch-wood charcoal 1. With any of these compositions fill the sack, and ram it, if possible, as hard as a stone,

putting in the opening a fuze, and about the same an iron ring $\frac{1}{5}$ th of the ball's diameter wide, and on the opposite end, another ring $\frac{1}{6}$ th of the ball's diameter; then with a strong cord of $\frac{1}{4}$ th of an inch diameter, lace round the hoops, or rings, from one end of the ball to the other, as often as requisite; this is called the ribbed-coat: then lace it again the contrary way, which is called the check-coat.

Between each square cord, iron barrels are drove in, $\frac{1}{3}$ d of which are filled with powder, and a bullet: at the end of each a small vent is made, that the composition may inflame the powder, and drive the balls out on every side,

which not only kill numbers of people, but prevent any one from extinguishing the fire-ball. The whole must, when finished, be dipped in melted pitch, rosin, and turpentine oil; which fastens the whole together.

Smoke-balls, are made and contrived to give an uncommon smoke, and thereby prevent the enemy from seeing what you are about. They are prepared as above, only the composition must be 5 to 1 of pitch, rosin, and saw-dust: the ingredients are put into iron shells, having 4 holes each to let out the smoke, and are thrown out of mortars.

Experiments with SMOKE-BALLS, in iron-shells, 1762.

Nature of Mort.	Shells wt.		powder		eleva.		Len. of pr.		time of smoke	range	Remarks.
	emp.	full					fuze	p. fire			
	lb.	lb.	lb.	oz.	°	'	inch.	inch.	' "	feet	
13	183	203	2	12	45		$1\frac{1}{2}$	$1\frac{1}{2}$	27	1668	They all gave a good smoke in general.
13	187	200 $\frac{1}{2}$	2	10	45		$1\frac{1}{2}$	$1\frac{1}{2}$	26 30	1678	
13	185	216	2	8	40		$1\frac{1}{2}$	$1\frac{1}{2}$	23 15	1438	
13	190	208	1	2	40	30	$1\frac{1}{2}$	$1\frac{1}{2}$	24	976	
10	78	97	1	4	45		$1\frac{1}{2}$	$1\frac{1}{2}$	26	1350	
10	76	98	1	5	45		$1\frac{1}{2}$	$1\frac{1}{2}$	30	1396	
10	80	93	1	6	45		$1\frac{1}{2}$	$1\frac{1}{2}$	28 30	1399	
10	79	96 $\frac{1}{2}$	1	7	36	30	$1\frac{1}{2}$	$1\frac{1}{2}$	36	1413	

N. B. The Powder was in flannel cartridges.

Stink-
Poisoned-
Red-hot-
Chain-
Stang-
Anchor-
Message-Balls. See SHELLS.

Balls. See BALLS.

Fire-Barrels, are at present not much used: they were of different sorts; some mounted on two wheels. The inside of the barrel is loaded with powder, and the outside full of sharp iron points, intermixed with grenades loaded, and

fuzes fixed. Sometimes they are placed under ground, and made use of to annoy the enemy's approach.

Carcass, in *military affairs*, was formerly of an oval form, made of iron bars, and filled with a composition of mealed-powder, saltpetre, sulphur, broken glass, shavings of horn, pitch, turpentine, tallow, and linseed-oil, covered with a pitched cloth: it is primed with mealed powder and quick-match, and fired out of a mortar. Its design is to set houses on fire, &c. See CARCASS at letter C.

Experiments with ROUND CARCASSES at an elevation of 45°.

Mortars	Weight of the carcass	Quantity of powder	Flight	Time of burning	Length of priming	Range	Remarks
	lb. oz.	lb. oz.	"	' "	inch.	feet	
10	62 13	8	6	3	2 $\frac{7}{10}$	390	} Burnt well in general. Fired from 7 to 9, in the morning. Good light.
0	64 12	12	8	3 12	2 $\frac{7}{10}$	774	
10	70	1	10	3 40	2 $\frac{7}{10}$	882	
10	71 12	1 4	11 $\frac{1}{2}$	4	2 $\frac{7}{10}$	1332	} Fired from 2 to 4 in the morning, very dark. Gave a very good light.
10	72	1 12	13	4 18	2 $\frac{7}{10}$	1815	
10	68 10	2	14	4 45	2 $\frac{7}{10}$	2043	
8	33 7	6	6	3 4	2 $\frac{7}{10}$	411	} Fired from 10 to 2 in the night. Had a very good effect.
8	36 12	10	8	3 20	2 $\frac{7}{10}$	963	
8	35 8	14	12	5	2 $\frac{7}{10}$	1344	
8	34 14	1	14	3 40	2 $\frac{7}{10}$	1680	
8	32 12	1 4	13	5 10	2 $\frac{7}{10}$	1908	

None but *round carcasses* are used at present, the flight of the oblong ones are so uncertain. The composition is, pitch 2, saltpetre 4, sulphur 1, and corned powder 3. When the pitch is

melted, the pot is taken off, and the ingredients (well mixed) put in; then the carcass is filled with as much as can be pressed in.

Experiments with 13-inch round IRON CARCASSES, with 4 holes; fired out of a 13-inch sea-service mortar, at Woolwich, in 1773.

Empty	Full	Powder	Elevation	Range	Remarks
c. qr. lb.	c. qr. lb.	lb. oz.	deg. m.	feet	
1 2 27	1 3 12	30	45	8700	One small piece burst from the carcass, and fell at 4500 feet distance; the other piece contained the composition. The two last did not break.
1 3 1	1 3 14	30	41	9000	
1 3 3	1 3 16	30	42	10200	
1 1 4	1 3 17	30	42 30	10500	

Cartridges, in military matters, are made of various substances, such as paper, parchment, bladders, and flannel. When they are made of paper, the bottoms remain in the piece, and accumulate so much, that the priming cannot reach the powder; besides other inconveni-

ences. When they are made of parchment or bladders, the fire shrivels them up, so that they enter into the vent, and become so hard, that the priming-iron cannot remove them so as to clear the vent. Nothing has been found hitherto to answer better than flannel, which is the only thing

thing used at present for artillery cartridges of all sorts, because it does not keep fire, and is therefore not liable to accidents in the loading; but, as the dust of powder passes through them, a parchment cover is sometimes made to put over them, which is taken off when used.

The best way of making flannel cartridges, is to boil the flannel in size; which will prevent the dust of powder from passing through them, and render them stiff, and more manageable; for without this precaution they are so pliable, when large, and contain much powder, that they are put into the piece with much difficulty.

The loading and firing guns with cartridges is done much sooner, and less liable to accidents, than with loose powder.

In quick firing the shot is fixed to the cartridge by means of a wooden bottom, hollowed on one side so as to receive nearly half the shot, which is fastened to it by 2 small slips of tin crossing over the shot, and nailed to the bottom; and the cartridge is tied to the other end thereof. They are fixed likewise in the same manner to the bottoms of grape-shot, which are used in field-pieces.

Fuzes, in artillery, are chiefly made of very dry beech-wood, and sometimes of horn-beam, taken near the root. They are turned rough, and bored at first, and then kept for several years in a dry place: the diameter of the hole

is about 1-4th of an inch: the hole does not go quite through, leaving about 1-4th of an inch at the bottom; and the head is made hollow in the form of a bowl.

The composition for fuzes is saltpetre 3, sulphur 1, and mealed powder, 3, 4, and sometimes 5. This composition is drove in with an iron driver, whose ends are capped with copper to prevent the composition from taking fire; and equally hard as possible; the last shovel-full being all mealed powder, and two stands of quickmatch laid across each other, being drove in with it, the ends of which are folded up into the hollow top, and a cap of parchment tied over it till used.

When these fuzes are drove into the loaded shell, the lower end is cut off in a slope, so that the composition may inflame the powder in the shell: the fuze must have such a length as to continue burning all the time the shell is in its range, and to set fire to the powder as soon as it touches the ground, which instantly bursts into many pieces. When the distance of the battery from the object is known, the time of the shell's flight may be computed to a second or two; which being known, the fuze may be cut accordingly, by burning 2 or 3, and making use of a watch or a string by way of a pendulum to vibrate seconds. See Table of Loaded-shells Experiments.

Table of FUZES, containing the greatest ranges corresponding to a given time of flight, and the length of fuze, allowing 4, 4½, or 5 seconds to each inch of fuze.

Time in seconds	Fuze in inches			Range in yards	Time in seconds	Fuze in inches			Range in yards	Time in seconds	Fuze in inches			Range in yards
	4	4.5	5			4	4.5	5			4	4.5	5	
1	0.25	0.22	0.20	5	5½	1.31	1.17	1.05	148	9½	2.38	2.11	1.90	485
1½	0.31	0.28	0.25	8	½	1.38	1.22	1.10	162	¾	2.44	2.17	1.95	510
2	0.38	0.33	0.30	12	¾	1.44	1.28	1.15	178	10	2.50	2.22	2.00	531
2½	0.44	0.40	0.35	16	6	1.50	1.33	1.20	193	¼	2.56	2.28	2.05	564
3	0.50	0.44	0.40	21	¾	1.56	1.40	1.25	210	½	2.60	2.33	2.10	592
3½	0.56	0.50	0.45	27	½	1.63	1.44	1.30	227	¾	2.69	2.40	2.15	621
4	0.62	0.55	0.50	34	¾	1.69	1.50	1.35	245	11	2.75	2.44	2.20	650
4½	0.69	0.61	0.55	41	7	1.75	1.56	1.40	263	¾	2.81	2.50	2.25	680
5	0.75	0.66	0.60	48	¾	1.81	1.61	1.45	282	1	2.88	2.56	2.30	710
5½	0.81	0.72	0.65	57	¾	1.88	1.67	1.50	302	¾	2.94	2.61	2.35	741
6	0.88	0.78	0.70	66	¾	1.94	1.72	1.55	323	12	3.00	2.67	2.40	773
6½	0.94	0.83	0.75	76	8	2.00	1.78	1.60	344	¾	3.06	2.72	2.45	806
7	1.00	0.90	0.80	86	¾	2.06	1.83	1.65	365	1	3.13	2.78	2.50	839
7½	1.06	0.94	0.85	97	¾	2.13	1.89	1.70	388	¾	3.19	2.83	2.55	873
8	1.13	1.00	0.90	109	¾	2.19	1.95	1.75	411	13	3.25	2.89	2.60	908
8½	1.19	1.06	0.95	121	9	2.25	2.00	1.80	435	¾	3.31	2.95	2.65	943
9	1.25	1.11	1.00	134	¾	2.31	2.06	1.85	459	1	3.38	3.00	2.70	979

L A B

L A B

Continuation of the TABLE.

Time in seconds	Fuze in inches			Range in yards	Time in seconds	Fuze in inches			Range in yards	Time in seconds	Fuze in inches			Range in yards
	4	4.5	5			4	.5	5			4	4.5	5	
13 1/4	3.44	3.06	2.75	1015	20 1/4	5.06	4.50	4.05	2208	26 1/4	6.69	5.95	5.35	3843
14 1/4	3.50	3.11	2.80	1053	21 1/4	5.13	4.56	4.10	2257	27 1/4	6.75	6.00	5.40	1315
15 1/4	3.56	3.17	2.85	1090	22 1/4	5.19	4.61	4.15	2311	28 1/4	6.81	6.06	5.45	3988
16 1/4	3.63	3.22	2.90	1129	23 1/4	5.25	4.67	4.20	2368	29 1/4	6.88	6.11	5.50	4061
17 1/4	3.69	3.28	2.95	1168	24 1/4	5.31	4.71	4.25	2425	30 1/4	6.94	6.17	5.55	4135
18 1/4	3.75	3.33	3.00	1208	25 1/4	5.38	4.78	4.30	2482	31 1/4	7.00	6.22	5.60	4210
19 1/4	3.81	3.40	3.05	1249	26 1/4	5.44	4.83	4.35	2540	32 1/4	7.06	6.28	5.65	4286
20 1/4	3.88	3.44	3.10	1290	27 1/4	5.50	4.89	4.40	2599	33 1/4	7.13	6.33	5.70	4362
21 1/4	3.94	3.50	3.15	1332	28 1/4	5.56	4.95	4.45	2658	34 1/4	7.19	6.40	5.75	4439
22 1/4	4.00	3.56	3.20	1375	29 1/4	5.63	5.00	4.50	2719	35 1/4	7.25	6.44	5.80	4516
23 1/4	4.06	3.61	3.25	1418	30 1/4	5.69	5.06	4.55	2779	36 1/4	7.31	6.50	5.85	4594
24 1/4	4.13	3.67	3.30	1462	31 1/4	5.75	.11	4.60	2841	37 1/4	7.38	6.56	5.90	4673
25 1/4	4.19	3.72	3.35	1507	32 1/4	5.81	5.17	4.65	2903	38 1/4	7.44	6.61	.95	4753
26 1/4	4.25	3.78	3.40	1552	33 1/4	5.88	5.22	4.70	2966	39 1/4	7.50	6.67	6.00	4833
27 1/4	4.31	3.83	3.45	1598	34 1/4	5.94	5.28	4.75	3029	40 1/4	7.56	6.72	6.05	4914
28 1/4	4.38	3.89	3.50	1645	35 1/4	6.00	5.33	4.80	3093	41 1/4	7.63	6.78	6.10	4995
29 1/4	4.44	3.95	3.55	1692	36 1/4	6.06	5.40	4.85	3158	42 1/4	7.69	6.83	6.15	5078
30 1/4	4.50	4.00	3.60	1740	37 1/4	6.13	5.44	4.90	3223	43 1/4	7.75	6.89	6.20	5161
31 1/4	4.56	4.06	3.65	1789	38 1/4	6.19	5.50	4.95	3289	44 1/4	7.81	6.95	6.25	5244
32 1/4	4.63	4.11	3.70	1838	39 1/4	6.25	5.56	5.00	3356	45 1/4	7.88	7.00	6.30	5328
33 1/4	4.69	4.1	3.75	1888	40 1/4	6.31	5.61	5.05	3424	46 1/4	7.94	7.06	6.35	5413
34 1/4	4.75	4.22	3.80	1939	41 1/4	6.38	5.67	5.10	3492	47 1/4	8.00	7.11	6.40	5499
35 1/4	4.81	4.28	3.85	1990	42 1/4	6.44	5.72	5.15	3561	48 1/4	8.06	7.17	6.45	5585
36 1/4	4.88	4.33	3.90	2040	43 1/4	6.50	5.78	5.20	3630	49 1/4	8.13	7.22	6.50	5662
37 1/4	4.94	4.40	3.95	2095	44 1/4	6.56	5.83	5.25	3700	50 1/4	8.19	7.28	6.55	5760
38 1/4	5.00	4.44	4.00	2148	45 1/4	6.63	5.89	5.30	3771					

N. B. The use of this table is obvious from inspection only. The use of the following table is to know the proper length of fuzes for all the different mortars, and their compositions for any proposed range; and, as fuzes burn equal lengths in equal times, hence the following rule. For instance, the range of an 8-inch shell is ordered to be 1206 yards: Quære, the length of the fuze. Say, As 32 seconds is to 7 inches, so is 15 seconds to 3.28 inches, the fuze's length required.

Second TABLE of FUZES.

Nat. of mortar	Total length of fuze		Diam. of fuze at neck		Diam. at the end		Diam. at the cap.		Length of composit.		Time of burning		Diam. of composit.		Diam. of fuze-holes	
	inch.	in. pts.	in.	pts.	in.	pts.	in.	pts.	in.	pts.	" "		in.	pts.	in.	pts.
13	10	5	2	2	1	47	2	5	8		35		58		1	7 1/2
10	9	36	1	65	1	5	1	86	7	5	33		51		1	8 1/2
8	8	5	1	6	1	1	1	86	7		32	5	42		1	10
roy.	4	5	1	2		86	1	3	3	75	22		25			
coh.	4		1			6	1	1	3		19	10	25			

Grape-shot, in artillery, is a combination of small shot, put into a thick canvas bag, and corded strongly together, so as to form a kind of cylinder, whose diameter is equal to that of the ball which is adapted to the cannon.

To make *grape-shot*, a bag of coarse cloth is made just to hold the bottom which is put into it; then as many shot as the grape is to contain; and with a strong pack-thread they are quilted to keep the shot from moving; and, when finished, they are put into boxes for carriage, to be transported wherever it is necessary.

The number of shot in a grape varies according to the service or size of the guns: in sea-service 9 is always the number; but by land it is increased to any number or size, from an ounce and a quarter in weight, to 4 pounds. It has not yet been determined, with any degree of accuracy, what number and size answers best in practice; for it is well known, that they often scatter so much, that only a small number take place. See PRACTICE.

Experiments with land GRAPE-SHOT, of 34 balls for a 6-pounder, 28 for a 3-pounder, and 20 for a 1½-pounder, against a canvas 12 feet square, the centre 6 feet from the ground, in 1768.

Nat.	Powder	Line of metal	Dist.	Shot	Remarks
pdrs.	lb. oz.	feet	feet	thro'	
6	1	2½ under cent.	600	8	Grazed at a great distance.
	1	8 2½ ditto	ditto	3	Rest close, a good grape.
	2	9 in. ditto	750	2	Spread round the object.
	2	8 2 under ditto	900		Grazed before the object.
3	3	3 under ditto	ditto	3	Very good grape. Some short.
	8	centre	600		Grazed from 15 to 20 feet short.
	12	ditto	680	6	Spread well.
1½	14	ditto	678	5	Spread well.
	6 2	feet over	750	2	Spread too high.
	6	centre	900	3	Ditto.

In this and the following table the columns are easily understood. By *greatest effect*, in the following table, is meant the effect of the best round in four, which were fired each at 30 minutes difference of elevation, beginning at 0 degrees; and that effect (or number through the curtain) is expressed in decimal parts of the

whole charge of grape; i. e. .33 means 33 hundredth parts of 9 lb. 4 oz. = 3.3 lb. nearly: so that if each experiment were sufficiently pursued, these numbers would exhibit the comparative powers or fitness of each different kind of piece for grape-shot, &c.

Ordnance			Weight of		Greatest effect at		Greatest effect at	
calib.	length	weight	powder	grape	200 yards.		300 yards	
			lb. oz.	lb. oz.	proportional parts.	weight of grape thro' lb.	proportional parts.	weight of grape thro' lb.
heavy 6-pdr.	F. In.	c. qr. lb.	4 8	9 14	.31	3.4	.33	3.3
	8 0	18 3 13	3 0	5 8	.31	1.6	.23	1.2
			2 0	9 14			.22	2.
			2 c	5 8			.29	1.6
light 6-pdr.	4 6	5 1 15	2 c	9 14	.34	3.4	.29	2.9
			1 8	5 8	.39	2.1	.38	2.
			1 0	5 0	.42	2.	.30	1.5
3-pdr.	3 6	2 2 19	0 12	5 0	.62	1.8	.40	1.2
8-in. how.	2 1½	11 3 c	2 0	38	.55	20.	.27	10.
5½ dit.	1 6	4 1 10	1 c	13 8	.27	3.6	.22	3.

Hence, it is to be observed, that of the 3 different sorts of cannon used in these experiments, the 3-pounder seems rather the best, proportionally; that is, it throws the largest share through the curtain; often its half-charge at that distance: so that the effect of two 3-pounders is much greater than that of one 6-pounder. But the 8-inch howitzer, which can be made to throw in from 3 to 5 of its charge (from 12 to 20 lb. of shot) becomes thereby a very formidable piece, when it can be used for grape-shot.

Proper charges for grape-shot have never yet been effectually determined: we can only give our advice from some experiments; that for heavy 6-pounders 1-3d of the weight of the shot appears to be the best charge of powder; for the light 6-pounders, 1-4th of the weight of the shot; and for howitzers, 1-8th or 1-10th answers very well.

This kind of fire seems not yet to have been enough respected, nor depended on. However, if cannon and howitzers can be made to throw 1-3d or 1-4th, and sometimes $\frac{1}{2}$ their charge of grape-shot into a space 39×12 feet, at 200 and 300 yards distance, and those fired 10 or 12 times in a minute; it surely forms the thickest fire that can be produced from the same space.

Tin-case-shot, in artillery, is formed by putting a great quantity of small iron shot into a cylindrical tin-box, called a canister, that just fits the bore of the gun. Leaden bullets are sometimes used in the same manner; and it must be observed, that whatever number or sizes of the shots are used, they must weigh, with their cases, nearly as much as the shot of the piece.

Case-shot, formerly, consisted of all kinds of old iron, stones, musket-balls, nails, &c. and used as above.

TABLE of TIN-CASE-SHOT.

Nature of pounders	Shot		Wt. of tin case oz.	Length of case inch.	Length fixed inch.	Diam. of shot in. pts.	Weight finished		Number in one pound
	Wt.	N ^o .					lb.	oz.	
	oz.	N ^o .							
42	6	94	15½	8¼	1¼	1.526	39	2½	2
32	6	72	15	8¼	1	1.030	27	2	2⅔
24 G	6¾	48	13½	8	1	1.410	21	12½	2⅔
24 F	4	84	13½	8	1	1.211	21	13½	4
18	4¾	38	9½	7¾	1	1.410	17	3½	2⅔
12 G	2	43	7½	6¼	⅞	1.211	10	12½	4
12 F	1½	107	7½	6¼	⅞	.961	10	8½	11⅔
9	2	73	5½	6	⅝	1.001	8	12½	5⅒
9 G	3	27	4½	5	⅝	1.000	5	5½	5⅒
6 F	1¾	56	4¾	5	⅝	.762	5	3	12
3	1⅛	34	2¾	4	⅝	.953	2	9⅝	14⅓
1½	1⅛	17	1¾	3⅒	⅝	.953	1	5⅝	14⅓
5½ H	6	70	8¼	4⅒	1	.961	9	4½	12
7½ H	6½	72	14	6⅒	1	1.410	32	6	2⅔

Explanation.—G stands for garrison-pieces, F for field-pieces, and H for howitzers.

Tubes, in artillery, are made use of in quick firing. They are made of tin: their diameter is 2-10ths of an inch, being just sufficient to enter into the vent of the piece; about 6 inches long, with a cap above, and cut slanting below, in the form of a pen: the point is strengthened with some solder, that it may pierce the cartridge without bending. Through this tube is drawn a quick-match, the cap being fitted with mealed powder, moistened with spirits of wine. To prevent the mealed powder from falling out by carriage, a cap of paper or flannel, steeped in spirits of wine, is tied over it.

Fire-ship, a vessel filled with combustible materials, and fitted with grappling-irons to hook, and set fire to the enemy's ships in battle, &c.

From the bulk-head at the fore-castle to a bulk-head to be raised behind the main chains, on each side and across the ship at the bulk-heads, is fixed, close to the ship-sides, a double row of troughs, 2 feet distance from each other, with cross troughs quite round, at about 2 $\frac{1}{2}$ distance; which are mortised into the others. The cross troughs lead to the sides of the ship, to the barrels, and to the port-holes, to give fire both to the barrels and to the chambers, to blow open the ports; and the side-troughs serve to com-

communicate the fire all along the ship and the cross troughs.

The timbers of which the troughs are made, are about 5 inches square; the depth of the troughs, half their thickness; and they are supported by cross pieces at every 2 or 3 yards, nailed to the timbers of the ship, and to the wood-work which incloses the fore and main masts. The decks and troughs are all well paved with melted rosin.

On each side of the ship 6 small port-holes are cut, from 15 to 18 inches large, the ports opening downwards, and are close caulked up. Against each port is fixed an iron chamber, which, at the time of firing the ship, blows open the ports, and lets out the fire. At the main and fore chains, on each side, a wooden funnel is fixed over a fire-barrel, and comes through a scuttle in the deck, up to the shrouds, to set them on fire. Both funnels and scuttles must be stopped with plugs, and have sail-cloth or canvass nailed close over them, to prevent any accident happening that way, by fire, to the combustibles below.

The port-holes, funnels, and scuttles, not only serve to give the fire a free passage to the outside and upper parts of the ship, and her rigging, but also for the inward air (otherwise confined) to expand itself, and push through those holes at the time of the combustibles being on fire, and prevent the blowing up the decks, which otherwise must of course happen, from such a sudden and violent rarefaction of the air as will then be produced.

In the bulk-head behind, on each side, is cut a small hole, large enough to receive a trough of the same size of the others; from which, to each side of the ship, lies a leading trough, one end coming through a sally-port cut through the ship's side, and the other fixing into a communicating trough that lies along the bulk-head, from one side of the ship to the other; and being laid with quick-match, at the time of firing either of the leading troughs, communicates the fire in an instant to the contrary side of the ship, and both sides burn together.

Fire-barrels, for a fire-ship, are cylindric, on account of that make answering better both for filling them with reeds, and for stowing them between the troughs: their inside diameters are about 21 inches, and their length 33. The bottom parts are first filled with double-dipt reeds set on end, and the remainder with fire-barrel composition, which is, corned powder 30 lb. Swedish pitch 12, saltpetre 6, and tallow 3, well mixed and melted, and then poured over them.

There are 5 holes of $\frac{3}{4}$ inches diameter, and 3 inches deep, made with a drift of that size in the top of the composition while it is warm; one in the centre, and the other four at equal distances round the sides of the barrel. When the composition is cold and hard, the barrel is primed by well driving those holes full of fuze composition, to within an inch of the top; then fixing in each hole a strand of quick-match twice doubled, and in the centre-hole two strands the whole length; all which must be well drove in with mealed powder: then lay the quick-match all within the barrel, and cover the top of it with a dipt curtain, fastened on with a hoop to slip over the head, and nailed on.

Bavins, for a fire-ship, are made of birch, heath, or other sort of brush-wood, that is both quickly fired, and tough: in length 2.5, or 3 feet; the bush-ends all laid one way, and the other ends tied with two bands each. They are dipped and sprinkled with sulphur the same as reeds, only that the bush-ends alone are dipped, and should be a little closed together by hand, as soon as done, to keep them more close, in order to give a stronger fire, and to keep the branches from breaking in shifting and handling them. Their composition is, rosin 120 lb. coarse sulphur 90, pitch 60, tallow 6, and mealed powder 12; with some fine sulphur for salting.

Iron-chambers, for a fire-ship, are 10 inches long, and 3.5 in diameter; breeched against a piece of wood fixed across the port-holes. When loaded, they are almost filled full of corned powder, with a wooden tompon well drove into their muzzles. They are primed with a small piece of quick-match thrust through their vents into the powder, with a part of it hanging out; and when the ship is fired, they blow open the ports, which either fall downwards, or are carried away, and so give vent to the fire out of the sides of the ship.

Curtains, for a fire-ship, are made of barras, about $\frac{3}{4}$ of a yard wide, and 1 yard in length: when they are dipped, 2 men, with each a fork, must run the prongs through the corner of the curtain at the same end; then dip them into a large kettle of composition (which is the same as the composition for bavins) well melted; and when well dipped, and the curtain extended to its full breadth, whip it between 2 sticks of about 5.5 feet long, and 1.5 inches square, held close by 2 other men to take off the superfluous composition hanging to it; then immediately sprinkle saw-dust on both sides to prevent its sticking, and the curtain is finished.

Reeds, for a fire-ship, are made up in small bundles

L A B

bundles of about 12 inches in circumference, cut even at both ends, and tied with two bands each: the longest sort is 4 feet, and the shortest 2.5; which are all the lengths which are used. One part of them are single-dipped, only at one end; the rest are double-dipped, i. e. at both ends. In dipping, they must be put about 7 or 8 inches deep into a copper kettle of melted composition (the same as that for bavins); and when drained a little over it, to carry off the superfluous composition, sprinkle them over a tanned hide with pulverised sulphur, at some distance from the copper.

STORES for a FIRE-SHIP of 150 tons.

	Number.	Value.
Fire-barrels - 8 -	8	£.80 0 0

L A D

Iron chambers - 12 - -	£.12 0 0
Priming composition barrels } 3½ - -	21 0 0
Quickmatch barrels 1 - -	3 0 0
Curtains dipped 30 - -	3 0 0
Long reeds single dipped } 150 - -	10 15 0
Short reeds { double dipped } 75 - -	2 18 9
{ single dipped } 75 - -	1 17 6
Bavins singledipped 209 - -	10 0 0
	£.144 11 3

Quantity of COMPOSITION for preparing the stores of a FIRE-SHIP.

		Petre	Sulphur	Corned Powder	Pitch	Rosin	Tallow	Tar	Oil-pots
For 8 barrels - - - - -				96c	480		8c		
For 3 barrels of priming composition - -		175	14c	350		21			11
For curtains, bavins, reeds, and sulphur to salt them			20c		350	175	50	25	
Total		175	340	131c	830	196	130	25	11

Total weight of the composition 3107 pounds, equal to C. 26: 3: 2.

Composition allowed for the reeds and barrels, $\frac{1}{5}$ of the whole of the last article, which is equal to 160 lb. making in the whole 3177 pounds, or C. 28: 1: 13.

Port-fires, in *artillery*, may be made any length: however, they are seldom made more than 20 inches. The interior diameter of port-fire moulds should be $\frac{10}{16}$ of an inch, and the diameter of the whole port-fire about $\frac{1}{2}$ an inch. The paper cases must be rolled wet with paste, and one end folded down. They are used instead of matches to fire artillery. The composition of wet port-fires is, salt-petre 6, sulphur 2, and meal powder 1; when it is well mixed and sieved, it is to be moistened with a little linseed oil: the composition for dry port-fire is, salt-petre 4, sulphur 1, meal powder 2, and antimony 1.

Rockets, in *pyrotechny*, an artificial firework, consisting of a cylindrical case of paper, filled with a composition of certain combustible ingredients; which, being tied to a stick, mounts into the air to a considerable height, and there bursts: they are frequently used as signals in war time.

Composition for sky-rockets in general is, salt-petre 4 lb. brimstone 1 lb. and charcoal 1½ lb: but for large sky-rockets, salt-petre 4 lb. meal-powder 1 lb. and brimstone 1 lb: for rockets of a middling size, salt-petre 3 lb. sulphur 2 lb. meal-powder 1 lb. and charcoal 1 lb.

Quick-match, in *artillery*, is of 2 sorts, cotton and worsted: the first is generally made of such cotton as is put in candles, of several sizes, from 1 to 6 threads thick, according to the pipes it is designed for. The ingredients are, cotton 1 lb. 12 oz. salt-petre 1 lb. 8 oz. spirits of wine 2 quarts, water 2 quarts, isinglass 3 gills, and meal powder 10 lb: it is then taken out hot, and laid in a trough where some meal powder, moistened with spirits of wine, is thoroughly wrought into the cotton. This done, they are taken out separately, and drawn through meal powder, and hung upon a line to dry.—The composition for the second is, worsted 10 oz. meal powder 10 lb. spirits of wine 3 pints, and white-wine vinegar 3 pints.

Scaling-LADDERS, are used in scaling when a place is to be taken by surprise. They are made several ways: here, we make them of flat staves, so as they may move about their pins,

L A D

LADDERS, and shut like a parallel ruler, for conveniently carrying them: the French make them of several pieces, so as to be joined together, and to be made of any necessary length: sometimes they are made of single ropes, knotted at proper distances, with iron hooks at each end, one to fasten them upon the wall above, and the other in the ground; and sometimes they are made with 2 ropes, and staves between them, to keep the ropes at a proper distance, and to tread upon. When they are used in the action of scaling walls, they ought to be rather too long than too short, and to be given in charge only to the stoutest of the detachment. The soldiers should carry these ladders with the left arm passed through the second step, taking care to hold them upright close to their sides, and very short below, to prevent any accident in leaping into the ditch.

The first rank of each division, provided with ladders, should set out with the rest at the signal, marching resolutely with their firelocks slung, to jump into the ditch: when they are arrived, they should apply their ladders against the parapet, observing to place them towards the salient angles rather than the middle of the curtain, because the enemy have less force there. Care must be taken to place the ladders within a foot of each other, and not to give them too much nor too little slope, so that they may not be overturned or broke with the weight of the soldiers mounting upon them.

The ladders being applied, they who have carried them, and they who come after, should mount up, and rush upon the enemy sword in hand: if he who goes first, happens to be overturned, the next should take care not to be thrown down by his comrade; but, on the contrary, immediately mount himself, so as not to give the enemy time to load his piece.

As the soldiers who mount first may be easily tumbled over, and their fall may cause the attack to fail, it would perhaps be right to protect their breasts with the fore-parts of cuirasses; because, if they can penetrate, the rest may easily follow.

The success of an attack by scaling is infallible, if they mount the 4 sides at once, and take care to shower a number of grenades amongst the enemy, especially when supported by some grenadiers and picquets, who share the attention and fire of the enemy.

LADLES, in *gunnery*, are made of copper, to hold the powder for loading of guns, with long handles of wood, when cartridges are not used.

L A Z

LADLES, in *laboratory business*, are very small, made of copper, with short handles of wood, used in filling the fuzes of shells, or any other composition, to fill the cases of sky-rockets, &c.

LANCE, or *javelin*, a sort of weapon, much used of old.

To LANCE, to throw a lance.

LANE, in a *military sense*, is where men are drawn up in two ranks facing one another, as in a street, for any great person to pass through, or sometimes for a soldier to run the gauntlet.

LANS-PESATE, } in some of the *foreign*
LANCE-PESATE, } *troops*, is a soldier that does duty as a corporal, especially on guards and detachments.

LANTERN, } commonly called Muscovy
LANTHORN, } lanterns, being a kind of dark-lanterns, used in the field, when dark, to light the gunners in the camp to prepare the stores, &c.

LASING-RINGS, } in *artillery*, with
LASHING-RINGS, } hoops, fixed on the side-pieces of travelling carriages, to lash the tarpauling, as also to tie the sponge, rammer, and ladle. See **CARRIAGE**.

LATH, in *building*, a long, thin, and narrow slip of wood, nailed to the rafters of a roof or ceiling, in order to fasten the covering. They are distinguished into three kinds, according to the different kinds of wood of which they are made, viz. heart of oak, sap-laths, deal-laths, &c.

LATITUDE, in *geography*, the distance of any place from the equator, measured in degrees, minutes, seconds, &c. upon the meridian of that place; and is either north or south, according as the place is situated either on the north or south side of the equator. See **GEOGRAPHY**.

LAW of arms, is a law which gives precepts how to proclaim a war, to attack the enemy, and to punish offenders in the camp.

Military-Law. See **COURTS-MARTIAL**.

LAW of marque, or *letters of marque*, that by which persons take the goods or shipping of the party that has wronged them, as in time of war, whenever they can take them within their precincts.

LAZARUS, } a military order instituted at
LAZARO, } Jerusalem by the Christians of the West, when masters of the holy land, who received pilgrims under their care, and guarded them on the roads from the insults of the Mahometans. This order was instituted in the year 1119, and confirmed by a bull of pope Alex-

LEA

Alexander IV. in 1255, who gave it the rule of St. Augustine.

LEAD, a metal well known: it is employed for various mechanic uses; as in thin sheets for covering buildings, for pipes, pumps, shot, bullets, windows, for securing iron bars in hard stones, for sundry kinds of large vessels for evaporation, and many other mechanic purposes. See BALLS.

LEAGUE, in *military history*, a measure of length, containing more or less geometrical paces, according to the different usages and customs of countries. A league at sea, where it is chiefly used by us, being a land-measure mostly peculiar to the French and Germans, contains 3000 geometrical paces, or 3 English miles.

The French league sometimes contains the same measure, and, in some parts of France, it consists of 3500 paces: the mean or common league consists of 2400 paces, and the little league of 2000. The Spanish leagues are larger than the French, 17 Spanish leagues making a degree, or 20 French leagues, or 69 and $\frac{1}{2}$ English statute miles. The German and Dutch leagues contain each 4 geographical miles. The Persian leagues are pretty near of the same extent with the Spanish; that is, they are equal to 4 Italian miles, which is pretty near to what Herodotus calls the length of the Persian parasang, which contained 30 stadia, 8 whereof, according to Strabo, make a mile.

LEAGUE, also denotes an alliance or confederacy between princes and states for their mutual aid, either in attacking some common enemy, or in defending themselves.

LEGATUS, in *Roman antiquity*, a military officer who commanded as deputy of the chief general.

LEGION, in *Roman antiquity*, a body of foot which consisted of ten cohorts.

The exact number contained in a legion, was fixed by Romulus at 3000; though Plutarch assures us, that, after the reception of the Sabines into Rome, he increased it to 6000. The common number afterwards, in the first times of the free state, was 4000; but, in the war with Hannibal, it rose to 5000; and after that, it is probable that it sunk again to 4200, which was the number in the time of Polybius.

LETTER of mart, } a letter granted to one

LETTER of marque, } of the king's subjects, under the privy-seal, empowering him to make reprisals for what was formerly taken from him by the subjects of another state, contrary to the law of mart. See MARQUE.

LEV

LETTER of mart, a commission granted by the lords of the admiralty, or by the vice-admiral of any distant province, to the commander of a merchant ship, or privateer, to cruise against, and make prizes of the enemy's ships and vessels, either at sea, or in their harbours.

LEVEL, an instrument to draw a line parallel to the horizon, whereby the difference of ascent or descent between several places may be found, for conveying water, draining fens, &c.

Air-LEVEL, that which shows the line of level by means of a bubble of air, inclosed with some liquor in a glass tube of an indeterminate length and thickness, whose two ends are hermetically sealed. When the bubble fixes itself at a certain mark, made exactly in the centre of the tube, the plane or ruler wherein it is fixed is level: when it is not level, the bubble will rise to one end. This glass tube may be set in another of brass, having an aperture in the middle, whence the bubble of air may be observed. There is one of these instruments with sights, being an improvement upon the last described, which, by the addition of more apparatus, becomes more commodious and exact: it consists of an air-level about 8 inches long, and 7 or 8 lines in diameter, set in a brass tube, with an aperture in the middle: the tubes are carried in a strong straight ruler, a foot long, at whose ends are fixed two sights, exactly perpendicular to the tubes, and of an equal height, having a square hole, formed by two fillets of brass crossing each other at right angles, in the middle whereof is drilled a very little hole, through which, a point on a level with the instrument is described: the brass tube is fastened on the ruler by means of two screws, one whereof serves to raise or depress the tube at pleasure, for bringing towards a level. The top of the ball and socket is riveted to a little ruler that springs, one end whereof is fastened with screws to the great ruler, and at the other end is a screw serving to raise and depress the instrument when nearly level.

Artillery foot-LEVEL, is in form of a square, having its two branches or legs of an equal length, at the angle of which is a small hole, whence hangs a line and plummet, playing on a perpendicular line in the middle of a quadrant: it is divided into twice 45 degrees from the middle. (Pl. XII. fig. 5.)

Gunner's-LEVEL, for levelling pieces of artillery, consists of a triangular brass plate, about 4 inches, at the bottom of which is a portion of a circle divided into 45 degrees; which angle is sufficient for the highest elevation of cannons, mor-

mortars, and howitzers, and for giving shot and shells the greatest range: on the centre of this segment of a circle is screwed a piece of brass, by means of which it may be fixed or screwed at pleasure; the end of this piece of brass is made so as to serve for a plummet and index, in order to show the different degrees of elevation of pieces of artillery. This instrument has also a brass foot, to set upon cannon or mortars, so that when these pieces are horizontal, the instrument will be perpendicular. The foot of this instrument is to be placed on the piece to be elevated, in such a manner, as that the point of the plummet may fall on the proper degree, &c. (Fig. 6.)

The most curious instrument for the use of the artillery, was lately invented by the very ingenious Capt. Congreve, of the royal artillery; having the following qualifications, viz. 1. It will find the inclination of any plane, whether above or below the horizon. 2. By applying it either to the cylinder, or outside, of any piece of ordnance, angles of elevation or depression may be given to the 60th part of a degree, with less trouble than the common gunner's quadrant, which only gives to the 4th part of a degree. 3. It will give the line of direction for laying either guns or mortars to an object above or below the horizon. 4. It will find the centre of metal of any piece of ordnance. 5. With it, a point may be found in the rear of a mortar-bed, in the vertical plane of the mortar's axis; consequently a longer line of sight is given for directing them to the object than the usual way. 6. It answers all the purposes of a pair of calipers, with the advantage of knowing (to the 100th part of an inch) diameters whether concave or convex, without the trouble of laying the claws upon a diagonal scale. 7. On the sides of the instrument are the following lines, viz. equal parts, solids, plains and polygons, logarithms, tangents, versed sines, sines and numbers, plotting scales, and diagonal scale of inches for cutting fuzes by. 8. In the lid of the instrument-case is a pendulum to vibrate half-seconds. It is likewise of singular use in surveying; as, 1. It takes horizontal angles to the 60th part of a degree. 2. Vertical angles. 3. Levels. 4. Solves right-angled plane triangles. 5. Oblique-angled plane triangles. 6. Answers all the purposes of a protractor, with the advantage of laying down angles exactly as taken in the field. N. B. Capt. Jordane's ingenious instrument answers nearly the same purposes.

LEVELLING, the finding a line parallel to the horizon at one or more stations, and so

to determine the height of one place in regard to another.

A truly level surface is a segment of any spherical surface, which is concentric to the globe of the earth. A true line of level is an arch of a great circle which is imagined to be described upon a truly level surface.

The apparent level is a straight line drawn tangent to an arch or line of a true level. Every point of the apparent level, except the point of contact, is higher than the true level: thus (Plate VI. fig. 1.) let EAG be an arch of a great circle drawn upon the earth: to a person who stands upon the earth at A , the line HD is the apparent level, parallel to his rational horizon RR ; but this line, the further it is extended from its station A , the further it recedes from the centre; for BC is longer than AC , and DC is longer than BC , &c.

The common methods of levelling are sufficient for laying pavements of walks, for conveying water to small distances, for placing horizontal dials, or astronomical instruments; but in levelling the bottoms of canals or ditches in a fortification, which are to convey water to the distance of many miles, the difference between the apparent and true level must be taken into the account: thus (fig. 2.) let IAL be an arch of a great circle upon the earth; let it be required to cut a canal, whose bottom shall be a true level from A to B , of the length of 5078 feet. The common method is, to place the levelling instrument in the bottom of the canal at A , and looking through the sights placed horizontally at a stick set up perpendicular at B , to make a mark where the visual ray or line of the apparent level points at E , and then to sink the bottom of the canal at B , as much below E as A is below D : but this will not give us a true level; for, according to Cassini's calculation, at the distance of 5078 feet, the apparent level is 7 inches above the true; and therefore, to make a true level, B must be sunk 7 inches lower than the apparent level directs; so that, if A be 4 feet below D , B must be 4 feet 7 inches below the mark E . We have here mentioned the error which will arise from placing the level at one end of the line to be levelled, and shown how to correct it; but, in most cases, it is better to make a station in the middle of the line to be levelled: thus, if the points H and B are to be levelled, place the instrument in the middle at A , and, setting up sticks perpendicular at H and B , make marks upon each stick where the apparent level points, as E and F : those points are level; and, if you sink H as much below F

as *B* is below *E*, *HAB* will be a true level. When the bottom of a canal is thus truly level, if water be let in at one end, it will rise to the same height at the other. If water be required to run with any velocity, that is of another consideration: a river will run, though very slowly, which hath not 6 inches descent below the true level for a mile in length. If a river whose water is foul, be required to run with such a velocity as to carry its foulness into the sea, 16 inches, or at least 1 foot, fall below the true level, in a mile running, have been thought sufficient by persons skilled in that affair.

This we thought necessary to premise before we explained the method used in levelling, which is as follows. Suppose the height of the point *A* (Plate VI. fig. 3.) on the top of a mountain, above that of the point *B* at the foot thereof, be required; place the level about the middle distance, between the two points, as in *D*, and staves in *A* and *B*; and let there be persons instructed with signals for raising and lowering on the staves little marks of pasteboard, or any such matter: the level being placed horizontally, &c. look towards the staff *AE*, and cause the mark to be raised or lowered, till the middle, upper edge, or other most conspicuous part, appear in the visual ray; then measuring exactly the perpendicular height of the point *E* above *A*, which suppose 8 feet 6 inches, set that down in your book; then turn the level horizontally about, that the eye-glass of the telescope may be still next the eye, when you look the other way, (if you have only plain sights, the instrument need not be turned) and cause the person at the staff *B* to raise or lower the mark till some conspicuous part fall in the visual ray, as at *C*: then measure the perpendicular of *C* above *B*, which suppose 20 feet 8 inches; set this also down in the book above the other numbers: subtract the one from the other; the remainder will be 12 feet 2 inches, which is the difference of level between *A* and *B*, or the height of the point *A* above *B*.

If the point *D*, where the instrument is fixed, be in the middle between *A* and *B*, there will be no necessity for reducing the apparent level to the true, the visual ray being then equally raised above the true level.

If it be farther required to know whether there be a sufficient descent for conveying water from the spring *A* to the point *B* (fig. 4.) here, as the distance from *A* to *B* is considerable, it is requisite that several operations be

made. Having then chosen a proper place for the first station, as at *I*, set up a staff in the point *A*, near the spring, with a proper mark to slide up and down the staff, as *L*; and measure the distance from *A* to *I*, which suppose 2000 yards. Then the level being adjusted in the point *K*, let the mark *L* be raised and lowered till you espy some conspicuous part through the telescope, or sights, and measure the height *AL*, which suppose 13 feet 5 inches. But in regard to the distance *AI*, which is 2000 yards, you must have recourse to your table for reduction, subtracting 11 inches, which will leave the height *AL* 12 feet 6 inches; and this note down in your book. Now turn the level horizontally, so as the eye-glass of the telescope may be towards the staff at *A*, and fixed upon another staff at *H*: cause the mark *G* to be moved up and down, till you can espy some conspicuous part: measure the height *HG*, which suppose 6 yards 4 feet 2 inches: measure likewise the distance of the points *IH*, which suppose 1300 yards; for which distance, 4 inches 8 lines must be subtracted from the height *HG*, which will leave but 6 yards, 3 feet, 9 inches, 4 lines, to be taken down in your book. This done, remove the level forwards to *E*, whence the staff *H* may be viewed, as also another staff at *D*; and proceed in every respect as before.

When a proper station for the level has been pitched upon between the two points, the two heights observed at that station must be written down in two columns; namely, under the first column, those observed when the eye was from the spring or towards the point, which may be called back-sights; and under the second column, those observed when the eye was next the spring, or the fore-sights.

Having summed up the height of each column separately, subtract the lesser from the greater, and the remainder will be the difference of level between *A* and *B*.

If the distance of the two points be required, add all the distances measured together; and, dividing the difference of height by the yards of the distances, for each 200 yards you will have a descent of about 2 inches 9 lines.

Dr. Halley suggests a new method of levelling, which is performed wholly by the barometer, in which the mercury is found to be suspended to so much the less height, as the place is more remote from the centre of the earth. Hence it follows, that the different height of the mercury in two places gives the difference of level.

Mr. Derham, from some observations at the top and bottom of the monument in London, found that the mercury fell 1-10th of an inch at every 82 feet of perpendicular ascent, when the mercury was at 30 inches. Dr. Halley allows of 1-10th of an inch for every 30 yards; and, considering how accurately barometers are now made, we think this method sufficiently exact to take levels for the conveyance of water, or any other military purposes, and indeed less liable to errors than the common levels. Mr. Derham also found a difference of 3 inches 8-10ths between the height of the mercury at the top and bottom of Snowdon-hill, in Wales.

For the common occasions of levelling, set a pole upright in a spring, pond, &c. and mark how many feet and inches are above water; then set up another pole of equal length with the other, in the place to which the water is to come. Place the centre of a quadrant on the top of this last pole, the plummet hanging free; spy through the sights the top of the pole in the water, and if the thread cuts any degree of the quadrant, the water may be conveyed by a pipe laid in the earth. If you cannot see from one extreme to the other, the operation may be repeated.

LEVELLING *staves*, instruments used in levelling, that carry the marks to be observed, and at the same time measure the heights of those marks from the ground. These usually consist of 2 wooden square rulers, that slide over one another, and are divided into feet, inches, &c.

LEVER, in *mechanics*, an inflexible line, rod, or beam, moveable about, or upon a fixed point, called the prop or fulcrum, upon one end of which is the weight to be raised; at the other end is the power applied to raise it, as the hand, &c.

Since the momentum of the weight and power are as the quantities of matter in each, multiplied by their respective celerities; and the celerities are as the distances from the centre of motion, and also as the paces passed through in a perpendicular direction in the same time; it must follow, that there will be an equilibrium between the weight and power, when they are to each other reciprocally as the distances from the centre, or as the celerities of the motions, or as the perpendicular ascent or descent in the same time; and this universally in all mechanical powers whatsoever, and which is therefore the fundamental principle of all mechanics. See MECHANICAL POWERS.

LIEUTENANT, is the second commis-

sioned officer in every company of both foot and horse, and next to the captain, and who takes the command upon the death or absence of the captain.

LIEUTENANT *of artillery*. Each company of artillery has 4; 1 first and 3 second lieutenants. The first lieutenant has the same detail of duty with the captain, because in his absence he commands the company: he is to see that the soldiers are clean and neat; that their clothes, arms, and accoutrements, are in good and serviceable order; and to watch over every thing else, which may contribute to their health. He must give attention to their being taught their exercise, see them punctually paid, their messes regularly kept, and to visit them in the hospitals when sick. He must assist at all parades, &c. He ought to understand the doctrine of projectiles and the science of artillery, with the various effects of gunpowder, however managed or directed: to enable him to construct and dispose his batteries to the best advantage; to plant his cannon, mortars, and howitzers, so as to produce the greatest annoyance to an enemy. He is to be well skilled in the attack and defence of fortified places, and to be conversant in arithmetic, mathematics, and mechanics, &c.

Second LIEUTENANT, in the *artillery*, is the same as an ensign in an infantry regiment, being the youngest commissioned officer in the company, and must assist the first lieutenant in the detail of the company's duty. His other qualifications should be equal with those of the first lieutenant.

LIEUTENANT $\left\{ \begin{array}{l} \text{of engineers. See ENGINEER.} \\ \text{colonel. See COLONEL.} \\ \text{general. See GENERAL.} \end{array} \right.$

LIEUTENANT *de roy*, the deputy-governor of all strong towns in France, who is a check upon the governor, and commands in his absence.

LIEUTENANT *reformed*, he whose company or troop is broke or disbanded, but continued in whole or half pay, and still preserves his right of seniority and rank in the army.

LIFE-GUARDS. See GUARDS.

LIGHT-HORSE. See CAVALRY.

LIMBER, in *artillery*, a two-wheel carriage with shafts to fasten the trail of travelling-carriages by means of a pintle or iron pin, when travelling, and taken off on the battery, or when placed in the park of artillery; which is called unlimbering the guns. See CARRIAGE.

LIME, in *military architecture*, is made of all kind of stones, that will calcine: that which is made of the hardest stones is the best, and

and the worst of all, that which is made of chalk.

Different counties in England produce different kinds of lime-stones. In Kent, abounding with chalk-pits, the lime is very bad. There are some rocks near Portsmouth, that make exceeding good lime. The best lime in England is that made of the marble in the neighbourhood of Plymouth. Before the stones are thrown into the kiln, they are to be broken into small pieces, otherwise the air contained in their cavities, being too much expanded by heat, makes them fly with so much violence as to damage the kilns. Lime will not be sufficiently burnt in less than 60 hours. The marks of well-burnt lime are, that its weight is to that of the stone in a sesquialterate proportion; that it be white, light, and sonorous; that when slaked, it sticks to the sides of the vessel, sending forth a copious thick smoke, and requires a great deal of water to slake it.

In some foreign parts they make good lime of all sorts of shells of sea-fish, which dries and hardens in a very short time; and when it is mixed with Dutch terras, is very fit for all kinds of aquatic works.

Lime should always be burnt with coals, and never with wood, the coals being strongly impregnated with sulphureous particles, which, mixed with the lime, make it more glutinous. See MORTAR.

LIMITS, in a *military sense*, is that distance which a centry is allowed on his post, namely, 50 paces to the right, and as many to the left; and though the weather be ever so bad, he must not get under cover.

LINCH-pin, in *artillery*, that which passes through the ends of the arms of an axle-tree, to keep the wheels or trucks from slipping off in travelling. See CARRIAGE.

LINCH-clout, in *artillery*, the flat iron under the ends of the arms of an axle-tree, to strengthen them, and to diminish the friction of the wheels. See CARRIAGE.

LINE, in *geometry*, a quantity extended in length only, without any breadth or thickness. It is formed by the flux or motion of a point.

There are two kinds of lines, viz. right lines and curve lines. Right lines are all those which go the nearest way to any given point. Curve lines are usually divided into geometrical and mechanical: the former are those which may be found exactly in all their points; the latter are those, some or all of whose points are not to be found precisely, but only tentatively, or nearly so.

Lines, considered as to their positions, are either parallel, perpendicular, or oblique, &c. Euclid's second book treats mostly of lines, and of the effects of their being divided, and again multiplied into one another.

LINE of battle, is the drawing up of an army for an engagement, extending its front as far as the ground will allow, that it may not be flanked. The Turkish armies often draw up in a curve line or half-moon, that, being very numerous, they may inclose the enemy. Christian armies generally form, or draw up, in 3 lines; the first called the *front*, the second the *centre*, and the third the *rear*; with a convenient distance between them, and intervals, so as not to put each other in confusion. See BATTLE.

LINES, in *fortification*, bear several names and significations; such as,

LINE of	{	<i>defence</i>	} See Fortification.
		<i>defence sabbant</i>	
		<i>defence razant</i>	
		<i>circumvallation</i>	
		<i>countervallation</i>	
		<i>counter-approach</i>	
		<i>defence prolonged</i>	
<i>Capital LINE</i> - - -			

LINES of communication, are trenches that unite one work to another, so that men may pass between them without being exposed to the enemy's fire: thence the whole intrenchment round any place is sometimes called a *line of communication*, because it leads to all the works.

Inside LINES, are a kind of ditches towards the place, to prevent sallies, &c.

Outside LINES, are a kind of ditches towards the field, to hinder relief, &c.

To LINE, in a *military sense*, is nothing more than to environ a rampart, parapet, or ditch, &c. with a wall of masonry or earth.

To LINE bedges, &c. to plant troops, artillery, or small arms, along them under their cover, to fire upon an enemy that advances openly, or to defend them from the horse, &c.

To break the LINE, to change the direction from that of a straight line, in order to obtain a cross-fire.

LINES, in a *military sense*, a name given to all kinds of works made by an army from one town or strong post to another, behind which it is encamped, to guard a part of the country, &c.

If an army is so weak as to be within *lines*, you take care to have communications between the villages, and small parties of light-horse patrolling towards the enemy, and to have videts and centries posted so near one another,

L I N

that you may have intelligence of all their transactions.

Turning out of the LINE, in a military sense. The line turns out without arms whenever the general commanding in chief, comes along the front of the camp.

When the *lines* turn out, the private men are drawn up in a line with the bells-of-arms; the corporals on the right and left of their respective companies: the picquet forms behind the colours, with their accoutrements on, but without arms.

The serjeants draw up one pace in the front of the men, dividing themselves equally.

The officers draw up in ranks, according to their commissions, in the front of the colours; two ensigns taking hold of the colours.

The field-officers advance before the captains.

The camp-colours on the flanks of the parade are to be struck, and planted opposite to the bells-of-arms; the officers esponsos are to be planted between the colours, and the drums piled up behind them; the halberts are to be planted between, and on each side the bells-of-arms, and the hatchets turned from the colours.

LINE of direction, in gunnery, is a line formerly marked upon guns, by a short point upon the muzzle, and a cavity on the basering, to direct the eye in pointing the gun; but is at present mostly left off.

LINE of { *least resistance, in mining.* See MINING.
march. See MARCH.
distance, the interval between two things, either in regard to time, place, or quantity.

LINE of gravitation, of any heavy body, is a line drawn through its centre of gravity, and according to which it tends downwards.

LINE of swiftest descent, of a heavy body, is the cycloid. See CYCLOID.

LINE { *of projectile.* See PROJECTILES.
in fencing, that part of the body opposite to the enemy, wherein the shoulders, the right arm, and the sword, should always be found; and wherein are also to be placed the two feet at the distance of 18 inches from each other. In which sense, a man is said to be in his line, or to go out of his line, &c.

LINE, also denotes a French measure, containing 1-12th part of an inch. It is of late frequently made use of in our calculations. See FENICHO.

LINKS, in the art of war, are distinct reins, or thongs of leather, used by the cavalry to link their horses together, when they dismount.

L O D

that they may not disperse. Every tenth man is generally left to take care of them.

LINS-pins. See LINC-PINS.

LINT-stick, in gunnery, a stick used by the gunners to fasten the match, which always keeps burning in time of action, ready to light the port-fires.

LIST, in a military sense, inclosed ground in which combats are fought.

To enter the Lists, is to contend with a person.

To LIST soldiers, to retain and enroll as soldiers, either as volunteers, or by a kind of compulsion.

LISTING. Persons listed, to be carried within four days, but not sooner than 24 hours after, before the next justice of peace of any county, riding, city, or place, or chief magistrate of any city or town-corporate (not being an officer in the army); and if, before such justice or magistrate, they dissent from such inlisting, and return the inlisting-money, and also 20 shillings in lieu of all charges expended on them, they are to be discharged.

But such persons, refusing or neglecting to return and pay such money within 24 hours, shall be deemed as duly listed, as if they had assented thereto before the proper magistrate; and they shall, in that case, be obliged to take the oath, or, upon refusal, they shall be confined by the officer who listed them, 'till they do take it.

Persons, owning before the proper magistrate, that they voluntarily listed themselves, are obliged to take the oath, or suffer confinement by the officer who listed them, 'till they do take it.

The magistrate is obliged, in both cases, to certify, that such persons are duly listed; setting forth their birth, age, and calling, if known; and that the second and sixth sections of the articles of war against mutiny and desertion were read to them, and that they had taken the oath.

Officers offending herein are to be cashiered, and displaced from their office; to be disabled from holding any post, civil or military; and to forfeit 100l.

Persons receiving inlisting-money from any officer, knowing him to be such; and afterwards absconding, and refusing to go before a magistrate to declare their assent or dissent, are deemed to be inlisted to all intents and purposes, and may be proceeded against as if they had taken the oath.

LIEZIERE. See BRAM. See FORTIFICATION.

LOCHABER-

LOCHABER-AX, a tremendous Scotch weapon, now used by none but the town-guard of Edinburgh; one of which is to be seen among the small armory in the Tower of London.

LOCKS, in *gunnery*, are of various sorts; common for lockers in travelling-carriages, or for boxes containing shot, powder, or cartridges. Also locks for fire arms.

To Lock, in a *military sense*, is to fasten one or more of the wheels from going round, in going down a hill, &c.

LOCKER-binges, serve to fasten the cover of the lockers in travelling-carriages.

LOCKING-plates, in *artillery*, are thin flat pieces of iron nailed on the sides of a field-carriage, where the wheels touch it in turning, to prevent the wearing the wood in those places. See **CARRIAGE**.

LOCKSPIT, in *field-fortification*, a small cut or trench made with a spade, about a foot wide, to mark out the first lines of a work.

LODGE-MENT, in *military business*, is a work made by the besiegers in some part of a fortification, after the besieged have been drove out, to maintain it, and to be covered from the enemy's fire.

When a *lodgement* is to be made on the glacis, covert-way, or in a breach, there must be a great provision made of fascines, sand-bags, gabions, wool-packs, &c. in the trenches; and, during the action, the pioneers (under the direction of an engineer) with fascines, sand-bags, &c. should be making the lodgement, in order to form a covering, while the grenadiers are storming the covert-way, &c.

LONGIMETRY, the art of measuring lengths, accessible and inaccessible.

LONGITUDE of the earth, denotes its extent from west to east, according to the direction of the equator.

LONGITUDE of a place, in *geography*, its distance from some first meridian, or an arch of the equator intercepted between the meridian of the place, and the first meridian. See **GEOGRAPHY**.

LONGITUDE of motion, according to some philosophers, is the distance which the centre of any moving body runs through, as it moves on in a right line. See **MOTION**.

LOOP, in a *ship-carriage*, made of iron, fastened one on the front of a fore axle-tree, and two on each side, through which the ropes or tackle pass, whereby the guns are moved backwards and forwards on board of ships.

Loop-holes, in old forts, &c. are square or oblong holes made in the wall to fire through with small arms.

LOUIS, or Knight of St. Louis, the name of a military order in France, instituted by Louis XIV. in 1693. Their collars are of a flame-colour, and pass from left to right: the king is always grand master.

LUNETTES, in *fortification*, are works made on both sides of the ravelin: one of their faces is perpendicular to half or two thirds of the faces of the ravelin; and the other nearly so to those of the bastions.

LUNETTES, are also works made beyond the second ditch, opposite to the places of arms: they differ from the ravelins only in their situation. See **FORTIFICATION**.

LUNETTONS, are a smaller sort of *lunettes*.
LYCANIENS. See **PANDOURS**.

M

MACHICOULIS, is an old word, sometimes applied to projections in old castles, and over gates of towns, left open above, to throw down stones, &c. on the approaching enemy.

MACHINE, in *general*, whatever hath force sufficient to raise or stop the motion of a heavy body.

MACHINES, are either simple or compound: the simple ones are the 7 mechanical powers, viz. lever, balance, pulley, axis and wheel, screw, and inclined plane. See **MECHANICAL POWERS**.

If the given power is not able to overcome the given resistance when directly applied, that is, when the power applied is less than the weight or resistance given; then the thing is to be performed by the help of a *machine* made with levers, wheels, pulleys, screws, &c. so adjusted, that when the weight and power are put in motion on the *machine*, the velocity of the power may be at least so much greater than that of the weight, as the weight and friction of the *machine*, taken together, is greater than the power; for on this principle depends the mechanism or contrivance of all mechanical engines.

gines used to draw or raise heavy bodies, or overcome any other force; the whole design of these being to give such a velocity to the power, in respect of the weight, as that the momentum of the power may exceed the momentum of the weight: for if *machines* are so contrived, that the velocity of the agent and resistant are reciprocally as their forces, the agent will just sustain the resistant, but with a greater degree of velocity will overcome it. So that if the excess of motion or velocity in the power is so great as to overcome all that resistance which commonly arises from the friction or attrition of contiguous bodies, as they slide by one another, or from the cohesion of bodies that are to be separated, or from the weights of bodies that are to be raised; the excess of the force remaining, after all these resistances are overcome, will produce an acceleration of motion thereto, as well in the parts of the *machine*, as in the resisting body.

Compound MACHINES, are formed by various combinations, and serve for different purposes; in all which the same general law takes place, viz. that the power and weight sustain each other, when they are in the inverse proportion of the velocities they would have in the directions wherein they act, if they were put in motion. Now, to apply this law to any compound *machine*, there are four things to be considered: 1. The moving power, or the force that puts the *machine* in motion; which may be either men or other animals, weights, springs, the wind, a stream of water, &c. 2. The velocity of this power, or the space it moves over in a given time. 3. The resistance, or quantity of weight to be removed. 4. The velocity of this weight, or the space it moves over in the same given time.

The two first of these quantities are always in the reciprocal proportion of the two last; that is, the product of the first two must always be equal to that of the last: hence, three of these quantities being given, it is easy to find the fourth; for example, if the quantity of the power be 4, its velocity 15, and the velocity of the weight 2, then the resistance, or quantity of the weight, will be equal to $\frac{4 \times 15}{2} = 30$.

The following rules will direct the mechanic how he may contrive his *machine*, that it may answer the intended purpose, to the best advantage.

1. Having assigned the proportion of your power, and the weight to be raised, the next

thing is to consider how to combine levers, wheels, pullies, &c. so that, working together, they may be able to give a velocity to the power, which shall be to that of the weight something greater than in the proportion of the weight to the power. This done, you must estimate your quantity of friction; and if the velocity of the power be to that of the weight still in a greater proportion than the weight and friction taken together are to the power; then your *machine* will be able to raise the weight. And note, this proportion must be so much greater, as you would have your engine work faster.

2. But the proportion of the velocity of the power and weight must not be made too great: for it is a fault to give a *machine* too much power, as well as too little: for if the power can raise the weight and overcome the resistance, and the engine perform its proper effect in a convenient time, and work well, it is sufficient for the end proposed: and it is in vain to make additions to the engine to increase the power any farther; for that would not only be a needless expence, but the engine would lose time in working.

3. As to the power applied to work the engine, it may be either a living power, as men, horses, &c. or an artificial power, as a spring, &c. or a natural power, as wind, water, fire, weights, &c.

When the quantity of the power is known, it matters not, as to the effect, what kind of power it is; for the same quantity of any sort will produce the same effect; and different sorts of powers may be applied in an equal quantity a great variety of ways.

The most easy power applied to a *machine* is weight, if it be capable of effecting the thing designed. If not, then wind, water, &c. if that can be conveniently had, and without much expence.

A spring is also a convenient moving power for several *machines*: but it never acts equally as the weight does; but is stronger when much bent, than when but a little bent, and that in proportion to the bending, or the distance it is forced to: but springs grow weaker by often bending, or remaining long bent; yet they recover part of their strength by lying unbent.

The natural powers, wind and water, may be applied to vast advantage in working of great engines, when managed with great skill and judgement. The due application of these has much abridged the labours of men, for there

there is scarce any labour to be performed, but an ingenious artificer can tell how to apply these powers to execute his design, and answer his purpose; for any constant motion being given, it may, by due application, be made to produce any other motions we desire. Therefore these powers are the most easy and useful, and of the greatest benefit to mankind. Besides, they cost nothing, nor require any repetition or renewing, like a weight or a spring, which require to be wound up. When these cannot be had, or cannot serve our end, we have recourse to some living power, as men, horses, &c.

4. Men may apply their strength several ways in working a *machine*. A man of ordinary strength, turning a roller by the handle, can act for a whole day against a resistance equal to 30 pounds weight; and if he works 10 hours in a day, he will raise a weight 30lb. $3\frac{1}{2}$ feet in a second; or if the weight be greater, he will raise it so much less in proportion.

But a man may act, for a small time, against a resistance of 50lb. or more.

If two men work at a windlass or roller, they can more easily draw up 70lb. than one man 30lb. provided the elbow of one of the handles be at right angles to that of the other: and with a fly or heavy wheel applied to it, a man may do 1-3d part more work; and for a little while act with a force, or overcome a continual resistance of 80lb. and work a whole day when the resistance is but 40lb.

Men used to carrying, such as porters, will carry some 150lb. others 200lb. or 250lb. according to their strength.

A man can draw but about 70 or 80lb. horizontally; for he can but apply half his weight.

If the weight of a man be 140lb. he can act with no greater force in thrusting horizontally, at the height of his shoulders, than 27lb.

A horse draws to greatest advantage, when the line of direction is a little elevated above the horizon, and the power acts against his breast; and can draw 200lb. for eight hours in a day, at two miles and a half an hour. If he draws 240lb. he can work but 6 hours, and not quite so fast; and, in both cases, if he carries some weight, he will draw better than if he carried none. And this is the weight a horse is supposed to be able to draw over a pulley out of a well. In a cart a horse may draw 1000lb. The most force a horse can exert is when he draws something above a horizontal position.

The worst way of applying the strength of a

horse, is to make him draw or carry up a hill: and three men with 100lb. on their backs, will climb up a steep hill faster than a horse with 300lb.

A round walk for a horse to draw in, at a mill, &c. should not be less than 40 feet diameter.

5. Every machine should be made of as few parts, and those as simple, as possible, to answer its purpose; not only because the expence of making and repairing will be less, but it will also be less liable to any disorder: and it is needless to do a thing with many, which may be done with fewer parts.

6. If a weight is to be raised but a very little way, the lever is the most simple, easy, and ready machine; or, if the weight be very great, the common screw is most proper: but if the weight is to be raised a great way, the wheel and axle is a proper power, and blocks and pulleys are easier still; and the same may be done by the perpetual screw.

Great wheels, to be wrought by men or cattle, are of most use and convenience, when their axles are perpendicular to the horizon; but if by water, &c. then it is best to have their axles horizontal.

7. As to the combination of simple *machines* together, to make a compound one, though the lever when simple cannot raise a weight to any great height, and in this case is but of little service; yet it is of great use when compounded with others. Thus the spokes of a great wheel are all levers perpetually acting; and a beam fixed to the axis to draw the wheel about by men or horses, is a lever. The lever also may be combined with the screw, but not conveniently with pulleys, or with the wedge. The wheel and axle is combined with great advantage with pulleys; but the perpetual screw combined with the wheel is very serviceable. The wedge cannot be combined with any other mechanical power; and it only performs its effect by percussion; but this force of percussion may be increased by engines.

Pulleys may be combined with pulleys, and wheels with wheels. Therefore if any single wheel would be too large, and take up too much room, it may be divided into 2 or 3 more wheels and trundles, or wheels and pinions, as in clock-work, so as to have the same power, and perform the same effect.

In wheels with teeth, the number of teeth that play together in 2 wheels, should be prime to each other, that the same teeth may not meet at every revolution; for when different
teeth

teeth meet, they by degrees wear themselves into a proper figure: therefore they should so be contrived that the same teeth meet as seldom as possible.

8. The strength of every part of the *machine* should be made proportional to the stress it is to bear: and therefore let every lever be made so much stronger, as its length and the weight it is to support are greater; and let its strength diminish proportionally from the fulcrum, or point where the greatest stress is to each end. The axles of wheels and pullies must be so much stronger as they are to bear greater weight. The teeth of wheels, and the wheels themselves, which act with greater force, must be proportionally stronger; and in any combination of wheels and axles, make their strength diminish gradually from the weight to the power, so that the strength of every part be reciprocally as the velocity it has. The strength of ropes must be according to their tension, and that is as the squares of their diameters: and, in general, whatever parts a *machine* is composed of, the strength of every particular part of it must be adjusted to the stress upon it; therefore in square beams the cubes of the diameters must be made proportional to the stress they bear: and let no part be stronger or bigger than is necessary for the stress upon it; not only for the ease and well going of the *machine*, but for diminishing of the friction; for all superfluous matter in any part of it, is nothing but a dead weight upon the machine, and serves for nothing but to clog its motion; and he is by no means a perfect mechanic, that does only adjust the strength to the stress, but who also contrives all the parts to last equally well, that the whole *machine* may fall together.

9. To have the friction as little as possible, the *machine* should be made of the fewest and simplest parts. The diameters of the wheels and pullies should be large, and the diameters of the arbors or spindles they run on, as small as can be consistent with their strength. All ropes and cords must be as pliable as possible, and for that end rubbed with tar or grease: the teeth of wheels must be made to fit and fill up the openings, and cut into the form of epicycloids. All the axles, where the motion is, and all teeth where they work, and all parts that in working rub upon one another, must be made smooth; and when the machine goes, must be oiled or greased.

10. When any motion is to be long continued, contrive the power to move or act at

ways one way, if it can be done; for this is better and easier performed than when the motion is interrupted, and the power is forced to move first one way, and then another; because every change of motion requires a new additional force to effect it. Besides, a body in motion cannot suddenly receive a contrary motion, without great violence: and the moving any part of the *machine* contrary ways by turns, with sudden jerks, tends only to shake the *machine* to pieces.

11. In a *machine* that moves always one way, endeavour to have the motion uniform.

12. But when the nature of the thing requires that a motion is to be suddenly communicated to a body, or suddenly stopped: to prevent any damage or violence to the engine by a sudden jolt, let the force act against some spring, or beam of wood, which may supply the place of a spring.

13. In regard to the size of the *machine*, let it be made as large as it can conveniently. The greater the *machine*, the exacter it will work, and perform all its motions the better; for there will always be some errors in the making, as well as in the materials, and consequently in the working of the *machine*. The resistance of the medium in some *machines* has a sensible effect: but all these mechanical errors bear a less proportion to the motion of the *machine* in great machines than in little ones; being nearly reciprocally as their diameters, supposing they are made of the same matter, and with the same accuracy, and are equally well finished: therefore in a small *machine* they are more sensible, but in a great one almost vanish; therefore great *machines* will answer better than small ones, in all respects, except in strength; for the greater the *machine*, the weaker it is, and less able to resist any violence.

14. For engines that go by water, it is necessary to measure the velocity and force of the water. To get the velocity, drop in pieces of sticks, &c. and observe how far they are carried in a second, or any given time.

But if it flows through a hole in a reservoir, or standing receptacle of water, the velocity will be found from the depth of the whole below the surface.

Thus let $s = 16\frac{1}{2}$ feet; $v =$ velocity of the fluid per second; $B =$ the area of the hole; $H =$ the height of the water; all in feet. Then the velocity $v = \sqrt{2sH}$, and its force $=$ the weight of the quantity $\frac{v}{21}$ B or HB of water, or $= \frac{62\frac{1}{2}}{112} HB$ hundred weight: be-

cause

cause a cubic foot $\equiv 62 \frac{1}{2}$ lb. avoirdup. Also a hoghead is about $8 \frac{1}{2}$ feet, or 531 lb. and a tun is 4 hogheads.

When you have but a small quantity of water, you must contrive it to fall as high as you can, to have the greater velocity, and consequently more force upon the engine.

15. If water is to be conveyed through pipes to a great distance, and the descent be but small, much larger pipes must be used, because the water will come slow.

Water should not be driven through pipes faster than 4 feet per second, by reason of the friction of the tubes; nor should it be too much wire-drawn, that is, squeezed through smaller pipes, for that creates a resistance, as water-way is less in narrow pipes.

16. When any thing is to be performed by a water-wheel, moved by the water running under it and striking the paddles or ladle-boards, the channel it moves in ought to be something wider than the hole of the adjutage, and so close to the floats on every side as to let little or no water pass; and when past the wheel, to open a little, that the water may spread. It is of no advantage to have a great number of floats or paddles; for those past the perpendicular are resisted by the back-water, and those before it are struck obliquely. The greatest effect that such a wheel can perform, in communicating any motion, is when the paddles of the wheel move with $\frac{1}{2}$ the velocity of the water, in which case, the force upon the paddle is $\frac{1}{4}$ only; supposing the absolute force of the water against the paddle, when the wheel stands still, to be 1: so that the utmost motion which the wheel can generate, is but $\frac{1}{2}$ of that which the force of the water against the paddles at rest would produce. This is when the wheel is at the best; but sometimes far less is done.

There is still another species of *machine*, which acts by a distinct power, the compression and expansion of air; invented and brought to perfection by the ingenious Mr. Blakey, who has obtained his majesty's patent for securing to himself the advantages that may result from their use.

MADRIERS, in the *military art*, are long planks of broad wood, used for supporting the earth in mining, carrying on a sap, making coffers, caponiers, galleries, and various other purposes at a siege; also to cover the mouth of petards after they are loaded, and are fixed with the petards to the gates or other places designed to

be forced open. When the planks are not strong enough, they are doubled with plates of iron.

MAGAZINE, a place in which stores are kept, or arms, ammunition, provisions, &c. Every fortified town ought to be furnished with a large magazine, which should contain stores of all kinds, sufficient to enable the garrison and inhabitants to hold out a long siege, and in which smiths, carpenters, wheel-wrights, bakers, &c. may be employed in making every thing belonging to the artillery, as carriages, waggons, &c.

Powder-MAGAZINE, is that place where the powder is kept in very large quantities. Authors differ greatly both in regard to situation and construction; but all agree, that they ought to be arched, and bomb-proof. In fortifications they are frequently placed in the rampart; but of late, they have been built in different parts of the town. The first powder-magazines were made with Gothic arches; but M. Vauban, finding them too weak, constructed them in a semicircular form, whose dimensions are, 60 feet long, within; 25 broad; the foundations are 8 or 9 feet thick, and 8 feet high from the foundation to the spring of the arch; the floor is 2 feet from the ground, which keeps it from dampness.

One of our engineers of great experience some time since had observed, that after the centres of semicircular arches are struck, they settle at the crown and rise up at the hances, even with a straight horizontal extrados, and still much more so in powder-magazines, whose outside at top is formed like the roof of a house, by two inclined planes joining in an angle over the top of the arch, to give a proper descent to the rain; which effects are exactly what might be expected agreeable to the true theory of arches. Now, as this shrinking of the arches, must be attended with very ill consequences, by breaking the texture of the cement after it has been in some degree dried, and also by opening the joints of the voussoirs at one end, so a remedy is provided for this inconvenience, with regard to bridges, by the *arch of equilibration* in Mr. Hurton's book on bridges; but, as the ill effect is much greater in powder-magazines, the same ingenious gentleman proposed to find an arch of equilibration for them also, and to construct it when the span is 20 feet, the pitch or height 10, (which are the same dimensions as the semicircle) the inclined exterior walls at top forming

ing an angle of 113 degrees, and the height of their angular point above the top of the arch, equal to 7 feet: this very curious question was answered in 1775 by the Rev. Mr. Wildbore, to be found in Mr. Hutton's *Miscellanea Mathematica*, See Plate III. fig. 3.

He supposes D and C to be two points in the required arch, and that D is a given one. Draw the tangents Dg , Cg , and the vertical line Hg through their intersection till it meets the roof IK in H : then, in order that the wall $ICDK$ may rest in equilibrio on the arch CD , it is necessary that its centre of gravity be in the line Hg : let Cb be an indefinitely small part of the tangent Cg , or the fluxion of the arch CD ; draw bb parallel to FK , or AB , and bq to Dg ; then, in order that the wall may be supported in equilibrio by two forces in the directions Cb , Dg , these forces, and the gravity of the wall, must be as the three sides Cb , $q b$, and $q C$ of the triangle $q C b$ parallel to those forces. This premised, let $FK = x$, $FC = y$, $CI = u$, $bC = y$, $bb = x$, $c =$ the tangent of $FKI = 30^\circ$, $30'$, $FI = cx$, $DG = m$, $KG = q$, ($g D$ being continued to G); bq (by sim. Δ s) $= \frac{yx}{q}$, $Cq = y - \frac{yx}{q}$, $bq = \frac{mx}{q}$, the constant force acting at D along the curve $= a$, and the wall or area $ICDK = p$; then, from what is premised, as $a : p :: \frac{mx}{q} : y - \frac{yx}{q}$, or $mpx = qay - nax$; or making x constant, $qay = mp \dot{x}$.

Now the area of the $\Delta FIK = \frac{cx^2}{2}$, its fluxion $= cx \dot{x}$, and consequently $\dot{p} = y \dot{x} - cx \dot{x}$, which being substituted for \dot{p} in the last equation, gives $qay = my \dot{x}^2 - mc \dot{x}^2$, or putting $\frac{q}{m} = Q$, $\frac{2y}{x^2} = y - cx = CI = u$; $\therefore y - cx = u$, $\ddot{y} = \ddot{u}$, $\frac{2\ddot{y}}{x^2} = \frac{2\ddot{u}}{x^2}$, and (taking the fluents) $\frac{2\ddot{u}}{x^2} = u^2$: but since u and \dot{u} do not begin together $\frac{2\ddot{u}}{x^2} = u^2 - d^2$, where $d =$ the value of u at the vertex of the curve $= 7$; consequently $\dot{x} = \frac{2\ddot{u}}{\sqrt{u^2 - d^2}}$, and (again taking the correct fluents)

$x = Q \frac{1}{2} \times \text{hyp. log. of } \frac{u + \sqrt{u^2 - d^2}}{d}$. Now, if we suppose D to be the vertex of the arch LA (the greatest value of u) $= b$, and AQ (the greatest value of x) $= g$, we obtain $Q \frac{1}{2} = \frac{g}{\text{hyp. log. } \frac{b + \sqrt{b^2 - d^2}}{d}}$

which being known, the curve may be readily constructed from the above equation, or from the following, viz. $u = \frac{M^2 + d^2}{2M}$, where $M = \frac{x}{dN\sqrt{2}}$ and $N = 2.71828$.

Corol. 1. Since at D the vertex, $FC = IC$, $g D$ the tangent to the curve there must be parallel to LK , and consequently the angle at the key-stone of the arch $=$ that of the roof.

Corol. 2. If the $\angle IKD$ be right, $c = 0$, $u = y$, and $x = Q \frac{1}{2} \times \text{hyp. log. } \frac{1 + \sqrt{y^2 - d^2}}{d}$; which being the same case, is likewise the same conclusion as that derived by a very different method, at page 40 of Mr. Hutton's *Principles of Bridges*.

Artillery-MAGAZINE, in a *siege*, the magazine is made about 25 or 30 yards behind the battery, towards the parallels, and at least 3 feet under ground, to hold the powder, loaded shells, portfires, &c. Its sides and roof must be well secured with boards, to prevent the earth from falling in: a door is made to it, and a double trench or passage is sunk from the magazine to the battery, one to go in and the other to come out at, to prevent confusion. Sometimes traverses are made in the passages to prevent ricochet shot from plunging into them. See Plate III.

MAGNITUDE, or *quantity*, any thing locally continued, or that has several dimensions. Its origin is a point, which though void of parts, yet its flux forms a line, the flux of that a surface, and of that a body, &c.

MAIN-BODY of the army, the body of troops that march between the advance and rear-guards. In a *camp*, that part of the army encamped between the right and left wings.

MAIN-GUARD, or *grand-guard*, a body of horse posted before a camp for the security of an army. In *garrison*, it is a guard generally mounted by a subaltern officer and about 24 men. See **GUARD**.

MAJOR, in the *art of war*, the name of several officers of very different ranks and functions.

MAJOR of a *regiment of foot*, the next officer to the lieutenant-colonel, generally promoted from the eldest captain: he is to take care that the regiment be well exercised, to see it march in good order, and to rally it in case of being broke in action: he is the only officer among the infantry that is allowed to be on horseback in time of action, that he may the more readily execute the colonel's orders.

MAJOR of a *regiment of horse*, as well as foot, ought to be a man of honour, integrity, understanding,

derstanding, courage, activity, experience, and address: he should be master of arithmetic, and keep a detail of the regiment in every particular: he should be skilled in horsemanship, and ever attentive to his business: one of his principal functions is, to keep an exact roster of the officers for duty: he should have a perfect knowledge in all the military evolutions, as he is obliged by his post to instruct others, &c.

Town-MAJOR, the third officer in order in a garrison, and next to the deputy-governor. He should understand fortification, and has a particular charge of the guards, rounds, patrols, and centinels.

Brigade-MAJOR, is a particular officer appointed for that purpose, only in camp: he goes every day to head-quarters to receive orders from the adjutant-general: there they write exactly whatever is dictated to them: from thence they go and give the orders, at the place appointed for that purpose, to the different majors or adjutants of the regiments which compose that brigade, and regulate with them the number of officers and men which each are to furnish for the duty of the army; taking care to keep an exact roster, that one may not give more than another, and that each march in their tour: in short, the major of brigade is charged with the particular detail in his own brigade, in much the same way as the adjutant-general is charged with the general detail of the duty of the army. He sends every morning to the adjutant-general an exact return, by battalion and company, of the men of his brigade missing at the retreat, or a report, expressing that none are absent: he also mentions the officers absent with or without leave.

As all orders pass through the hands of the majors of brigade, they have infinite occasions of making known their talents and exactness.

MAJOR of artillery, is also the next officer to the lieutenant-colonel. His post is very laborious, as the whole detail of the corps particularly rests with him; and for this reason all the non-commissioned officers are subordinate to him, as his title of serjeant-major imports: in this quality they must render him an exact account of every thing which comes to their knowledge, either regarding the duty or wants of the artillery and soldiers. He should possess a perfect knowledge of the power of artillery, together with all its evolutions. In the field he goes daily to receive orders from the brigade-major, and communicates them with the parole to his superiors, and then dictates them to the

adjutant. He should be a very good mathematician, and be well acquainted with every thing belonging to the train of artillery, &c.

MAJOR of engineers, commonly with us called sub-directors, should be very well skilled in military architecture, fortification, gunnery, and mining. He should know how to fortify in the field, to attack and defend all sorts of posts, and to conduct the works in a siege, &c. See **ENGINEER**.

Aid-MAJOR, is on sundry occasions appointed to act as major, who has a pre-eminence above others of the same denomination. Our horse and foot-guards have their guidons, or second and third majors.

Serjeant-MAJOR, is a non-commissioned officer, of great merit and capacity, subordinate to the adjutant, as he is to the major. See **SERJEANT**.

Drum-MAJOR, is not only the first drummer in the regiment, but has the same authority over his drummers as the corporal has over his squad. He instructs them in their different beats; is daily at orders with the serjeants, to know the number of drummers for duty. He marches at their head when they beat in a body. In the day of battle, or at exercise, he must be very attentive to the orders given him, that he may regulate his beats according to the movements ordered.

Fife-MAJOR, is he that plays the best on that instrument, and has the same authority over the fifiers as the drum-major has over the drummers. He teaches them their duty, and appoints them for guards, &c.

MALLEABLE, in the *art of founding*, a property of metals, whereby they are capable of being extended under the hammer.

MARTIOBARBULI, in *ancient military history*, a sort of loaded javelins, five of which each soldier carried in the concavity of his shield.

Knights of MALTA, otherwise called *Hospitallers of St. John of Jerusalem*, a religious military order, whose residence is in the island of Malta. The order consists of three estates, the knights, chaplains, and servants at arms: none are admitted into this order, but such as are of noble birth. They never marry, yet have continued from 1090 to the present time.

MANEGE, or *Manage*, in *horsemanship*, the exercise of riding the great horse, or the ground set apart for that purpose; which is sometimes covered, for continuing the exercise in bad weather; and sometimes open, in order to give more liberty and freedom both to the horseman and horse.

M A N

MANIFESTO, in *military history*, a public declaration made by a prince in writing, showing his intentions to begin a war, or rather enterprise, with the motives that induce him to it, and the reasons on which he founds his rights and pretensions.

MANIPULUS, in *ancient military history*, a body of Roman infantry, consisting of 200 men, and constituting the third part of a cohort.

MANŒUVRE, in a *military sense*, consists solely in distributing equal motion to every part of a body of troops, to enable the whole to form, or change their position, in the most expeditious and best method, to answer the purposes required of a battalion, brigade, or line of cavalry, infantry, or artillery. It has always been lamented, that men have been brought on service without being informed of the uses of the different manœuvres they have been practising; and having no ideas of any thing but the uniformity of the parade, instantly fall into disorder and confusion when they lose the step, or see a deviation from the straight lines they have been accustomed to at exercise. It is a pity to see so much attention confined to show, and so little given to instruct the troops in what may be of use to them on real service.

No manœuvre should be executed in the presence of the enemy, unless protected by some division of the troops.

MANTELETS, in a *military sense*, are either single or double, composed of great planks of wood, of about 5 feet high, and 3 inches thick. The single ones are sometimes covered with tin, made musket-proof, which the pioneers generally roll before them, being fixed upon wheels, to cover them from the enemy's fire, in opening the trenches, or carrying on the sap, &c. The double ones form an angle, and stand square, making two fronts, which cover both the front and flank of the sappers, &c. when at work: these have double planks, with earth rammed in between them: they are 5 feet high, and 3 in breadth, sometimes covered with plates of iron. They may with propriety be called a moving parapet, having a shaft to guide them by.

MAP, in a *military and geographical sense*, is a plane figure, representing the surface of the earth, or a part thereof, according to the laws of perspective; distinguishing the situation of cities, mountains, rivers, roads, &c.

In maps these three things are essentially necessary. 1. That all places have the same situation and distance from the great circles therein, as on the globe, to show their parallels, longi-

M A P

tudes, zones, climates, and celestial appearances. 2. That their magnitudes be proportionable to the real magnitudes on the globes. 3. That all places have the same situation, bearing, and distance, as on the earth itself.

MAPS are either universal, which exhibit the whole surface of the earth; or partial, which exhibit some particular part thereof: each kind is called geographical or land-maps, in contradistinction to hydrographical or sea-maps, representing the seas and sea-coasts, properly called charts.

As a *map* is a representation of some part of the surface of the earth delineated upon a plane; the earth being round, no part of the spherical surface of it can be accurately exhibited upon a plane; and therefore some have proposed the making of globular *maps*. For this purpose a plate of brass might be hammered, or at a less expence a piece of paste-board might be formed into a segment of a sphere, and covered on its convex side with a *map* projected in the same manner as the papers of the common globe are. A *map* made in this method would show every thing in the same manner, as it would be seen upon a globe of the same diameter with the sphere upon the segment of which it was delineated: and, indeed, maps of this sort would in effect be segments of such a globe; but they are not in common use.

The ancients described all parts of the known earth in one general *map*. In this view one of them compares the shape of the earth to the leather of a sling, whose length exceeds its breadth: the length of the then known parts of the earth from east to west was considerably greater, than from north to south; for which reason, the former of these was called the longitude, and the other the latitude.

The modern general *maps* are such as give us a view of an entire hemisphere, or half of the globe; and are projected upon the plane of some great circle, which terminates the projected hemisphere, and divides it from the other half of the globe, as the equator, the meridian, or horizon of some place. From the circle the projection is denominated, and said to be equatorial, meridional, or horizontal.

Particular *maps* are such as exhibit to us less than an hemisphere: of this sort are *maps* of the great parts into which the earth is divided; as Europe, Asia, Africa, and America; or *maps* of particular kingdoms, provinces, countries, or of lesser districts.

A particular *map* is a part of a general one, and may be made upon the same principles, as by

by projecting a large hemisphere, and taking so much of it as the *map* is designed to contain. When we are to delineate a *map* of the smaller part of the earth, if it be near the equator, the meridians and parallels may be represented by equi-distant straight lines. If at some distance from the equator, the parallels may be equi-distant straight lines, and the meridians straight lines, a little converging towards the nearest pole; or the meridians may be straight lines, converging towards the nearest pole, and the parallels circular.

When we are to make a *map* of a very small district, as of a county or hundred, whatever part of the earth it be in, the meridians and parallels may be equi-distant straight lines, drawn through every minute, &c. of longitude, according as the largeness of the *map* will allow. See PLOTTING and SURVEYING.

The use of *maps* is obvious from their construction. The degrees of the meridians and parallels shew the longitude and latitude of places; their bearings from each other appear from inspection; and their distances from each other may be measured by the divisions on the meridian, equator, or scales. See GEOGRAPHY.

MARAUDING, in a *military sense*, means a party of soldiers, who, without any order, go into the neighbouring houses or villages, when the army is either in camp or garrison, to plunder and destroy, &c. Marauders are a disgrace to the camp, to the military profession, and deserve no better quarters from their officers than they give to poor peasants, &c.

A MARCH, is the moving of a body of men from one place to another. Care must be taken, in marching of troops, that they are not liable to be flanked or intercepted; for of all operations none is more difficult, because they must not only be directed in the objects they have in view, but according to the movements the enemy may have made.

Of all the mechanical parts of war, none is more essential than that of marching. It may be justly called the key which leads to all sublime motions and manœuvres of an army; for they depend entirely on this point. A man can be attacked in four different ways; in the front, on both flanks, and in the rear: but he can defend himself, and annoy the enemy, only when placed with his face towards him. Hence it follows, that the general object of marching, is reduced to three points only; to march forwards, and on both sides, because it is impossible to do it for any time backwards, and by that means face the enemy wherever he presents himself. The dif-

ferent steps to be made use of are three; slow, fast, and oblique. The first is proper in advancing, when at a considerable distance from the enemy, and when the ground is unequal, that the line may not be broke, and a regular fire kept up without intermission. The second is chiefly necessary, when you want to anticipate the enemy in occupying some post, in passing a defile, and, above all, in attacking an intrenchment, to avoid being a long while exposed to the fire of the artillery and small-arms, &c. The third step is of infinite consequence, both in the infantry and cavalry: columns may be opened and formed into lines, and, *vice versa*, lines into columns, by this kind of step, in a lesser space, and consequently in less time, than by any other method whatsoever. In coming out of a defile, you may instantly form the line without presenting the flank to the enemy. The line may be formed, though ever so near to the enemy, with safety, because you face him, and can with ease and safety protect and cover the motion of the troops, while they are coming out of the defiles, and forming. The same thing may be equally executed, when a column is to be formed, in order to advance or retreat; which is a point of infinite consequence, and should be established as an axiom.

The order of *march* of the troops must be so disposed, that each should arrive at their rendezvous, if possible, on the same day. The quarter-master-general, or his deputy, with an able engineer, should sufficiently reconnoitre the country, to obtain a perfect knowledge of it and the enemy, before he forms his routes.

Before a *march*, the army generally receives several days bread. The quarter-masters, camp-colour-men, and pioneers, parade according to orders, and march immediately after, commanded by the quarter-master-general, or his deputy. They are to clear the roads, level the ways, make preparations for the march of the army, &c. The *general*, for instance, beats at 2, the *assembly* at 3, and the army to march in 20 minutes after. Upon beating the *general*, the village, and general officer's guards, quarter and rear guards, join their respective corps; and the army pack up their baggage. Upon beating the *assembly*, the tents are to be struck, and sent with the baggage to the place appointed, &c.

The companies draw up in their several streets, and the rolls are called. At the time appointed, the drummers are to beat a march, the *officers* play at the head of the line; upon which

which the companies *march* out from their several streets, form battalions as they advance to the head of the line, and then halt.

The several battalions will be formed into columns by the adjutant-general, and the order of march, &c. be given to the general officers who lead the columns.

The cavalry generally march by regiments or squadrons. The heavy artillery always keeps the great roads, in the centre of the columns, escorted by a strong party of infantry and cavalry. The field-pieces march with the columns.

Each soldier generally marches with 36 rounds of powder and ball, and 2 good flints; one of which is to be fixed in the cock of his firelock. The routes must be formed, so that no columns cross another on the march.

MARQUE, or *Letters of Marque*, in military affairs, are letters of reprisal, granting the subjects of one prince or state liberty to make reprisals on those of another. See **LETTERS of MARQUE**.

MARINE, implies, in general, the whole navy of a kingdom or state, comprehending all the royal dock-yards, and the officers, artificers, seamen, soldiers, &c. employed therein, as well as the shipping employed by the merchants for military or commercial purposes; together with whatever relates to navigation, ship-building, sailors, and marines.

The history of the marine affairs of any one state is a very comprehensive subject; much more that of all nations. Not only the preservation of that share of commerce we at present possess, but its future advancement, and even the very being of Britain, as an independent empire, and a free people, depend no less on the good condition and the wise regulation of our affairs of the marine, than on the superiority of its naval power. The Delphian oracle being consulted by the Athenians, on the formidable armament and innumerable forces of Xerxes, returned for answer, "that they must seek their safety in "wooden walls." To which we may affirm, that whenever this nation in particular has recourse to her floating bulwarks for her security and defence, she will find strength, wealth, and glory, to be the happy and infallible consequence.

MARINE forces, } a body of soldiers, raised for
MARINES, } the sea-service, and trained to fight either in a naval engagement, or in an action on shore. They are under the direction of the lords of the admiralty. The marine forces of Great-Britain, in time of peace, are stationed in 3 divisions, one of which is quar-

tered at Chatham, one at Portsmouth, and another at Plymouth; that is, 16 companies at Chatham, 27 at Portsmouth, and 27 at Plymouth; making in all 70 companies.

MARLIN, in *artillery*, are tarred white skains or long wreaths or lines of untwisted hemp, dipped in pitch or tar, with which cables and other ropes are wrapped round, to prevent their fretting or rubbing in the blocks or pulleys through which they pass. The same serves in artillery upon ropes used for rigging gins, usually put up in small parcels called skains.

MARSHAL, } in its primitive significa-
Field-MARSHAL, } tion, means an officer who has the care and charge of horses; but it is now applied to officers who have very different employments. In a military sense, it means the commander in chief of all the forces. See **GENERAL**.

MARSHAL of France, an officer of the greatest dignity in the French army. It was first established by Philip-August, in the year 1185.

MARSHAL de camp. See **MAJOR-GENERAL**.

MARTIAL-Law, is the law of war, which entirely depends on the arbitrary power of the prince, or of those to whom he has delegated it; for, though the king can make no laws in time of peace without the consent of parliament, yet in time of war he uses an absolute power over the army.

MASTER at arms, in the *marine*, an officer appointed to teach the officers and crew of a ship of war the exercise of the small-arms; to confine, and plant centinels over, the prisoners, and superintend whatever relates to them during their confinement. He is also to observe that the fire and lights are all extinguished as soon as the evening-gun is fired, except those that are permitted by proper authority, or under the inspection of centinels. It is likewise his duty to attend the gang-way, when any boats arrive aboard, and search them carefully, together with their rowers, that no spirituous liquors may be conveyed into the ship, unless by permission of the commanding officer. In these several duties he is assisted with proper attendants, called his corporals, who also relieve the centinels, and one another, at certain periods.

MASTER gunner, in a *ship of war*, an officer appointed to take charge of the artillery and ammunition aboard, and to teach the men the exercise of the great guns.

MASTER of the horse, a great officer of the crown; who orders all matters relating to the king's stables, races, breed of horses; and commands

hands the equerries and all the other officers and tradesmen in the king's stables. His coaches, horses, and attendants, are the king's, and bear the king's arms and livery.

MASTER-general of the ordnance. See **ORDNANCE**.

MATCH, in *artillery*, a kind of rope slightly twisted, and prepared to retain fire for the uses of the artillery, mines, fire-works, &c. It is made of hempen tow, spun on the wheel like cord, but very slack; and is composed of three twists, which are afterwards again covered with tow, so that the twists do not appear: lastly, it is boiled in the lees of old wines. This, when once lighted at the end, burns on gradually, without ever going out, 'till the whole be consumed. It is mounted on a lint-stock.

Quick MATCH, used in *artillery*, made of three cotton strands drawn into lengths, and put into a kettle just covered with white wine vinegar, and then a quantity of saltpetre and mealed powder is put in it, and boiled 'till well mixed. Others put only saltpetre into water, and after that take it out hot, and lay it into a trough with some mealed powder, moistened with some spirits of wine, thoroughly wrought into the cotton by rolling it backwards and forwards with the hands; and when this is done, they are taken out separately, drawn through mealed powder, and dried upon a line. See **LABORATORY**.

MATHEMATICS, from *μαθημας*, originally signified any disciple of learning; but, at present, denotes that science which teaches, or contemplates, whatever is capable of being numbered or measured, in so far as being computable or measurable; and accordingly is subdivided into arithmetic, which has numbers for its object, and geometry, which treats of magnitude.

MATHEMATICS are commonly distinguished into pure and speculative, which consider quantity abstractedly; and mixed, which treat of magnitude as subsisting in material bodies, and consequently are interwoven every where with physical considerations.

Mixed MATHEMATICS are very comprehensive, since to them may be referred astronomy, optics, geography, hydrography, hydrostatics, mechanics, fortification, gunnery, projectiles, mining, engineering, and navigation.

Pure mathematics have one peculiar advantage, that they occasion no disputes among wrangling disputants, as in other branches of knowledge; and the reason is, because the definitions of the terms are premised, and every

one that reads a proposition has the same idea of every part of it. Hence it is easy to put an end to all mathematical controversies, by showing, that our adversary has not stuck to his definitions, or has not laid down true premises, or else that he has drawn false conclusions from true principles; and, in case we are able to do neither of these, we must acknowledge the truth of what he has proved.

It is true, that in mixed mathematics, where we reason mathematically upon physical subjects, we cannot give such just definitions as the geometers: we must therefore rest content with descriptions; and they will be of the same use as definitions, provided we are consistent with ourselves, and always mean the same thing by these terms we have once explained.

Dr. Barrow gives a most elegant description of the excellence and usefulness of mathematical knowledge, in his inaugural oration, upon being appointed professor of mathematics at Cambridge.

The mathematics, he observes, effectually exercise, not vainly delude, nor vexatiously torment studious minds with obscure subtleties; but plainly demonstrate every thing within their reach, draw certain conclusions, instruct by profitable rules, and unfold pleasant questions. These disciplines likewise inure and corroborate the mind to constant diligence in study; they wholly deliver us from a credulous simplicity, most strongly fortify us against the vanity of scepticism, effectually restrain us from a rash presumption, most easily incline us to a due assent, perfectly subject us to the government of right reason. While the mind is abstracted and elevated from sensible matter, distinctly views pure forms, conceives the beauty of ideas, and investigates the harmony of proportions; the manners themselves are sensibly corrected and improved, the affections composed and rectified, the fancy calmed and settled, and the understanding raised and excited to more divine contemplations.

MATROSSES, are properly apprentices to the gunner, being soldiers in the royal regiment of artillery, and next to them: they assist in loading, firing, and spunging the great guns. They carry firelocks, and march along with the guns and store-waggons, both as a guard, and to give their assistance on every emergency.

MATTUCASHLASH, an ancient Scotch weapon, sometimes called arm-pit dagger, was worn there, ready to be used on coming to close quarters. This, with a pistol stuck in the the girdle, completely armed the highlanders.

MAXIMS,

MAXIMS, in *fortification*. See **FORTIFICATION**.

MEASURE, in *geometry*, any quantity assumed as one, to which the ratio of other homogeneous or similar quantities is expressed.

MEASURE of an angle, the length of an arch described from the vertex to any place between its legs: hence angles are distinguished by the ratio of the arches between the legs to the peripheries. See **ANGLE**.

MEASURE of a figure, is a square, whose side is an inch, foot, yard, or other determinate measure. Hence square measures.

Among geometers it is usually a square rod called *decempeda*, divided into 10 square feet, and those into square digits, and those again into 10 lines, &c.

MEASURE of a line, any right line taken at pleasure, and considered as unity.

MEASURE of the mass or quantity of matter, in *mechanics*, is its weight; it being apparent that all the matter which coheres with a body, gravitates with it; and it being found by experiment, that the gravities of homogeneous bodies are in proportion to their bulks: hence, while the mass continues the same, the absolute weight will be the same, whatever figure it puts on; for as to its specific weight, it varies as the quantity of its surface does.

MEASURE of a number, in *arithmetic*, such a number as divides another without leaving a fraction: thus 9 is a measure of 27.

MEASURE of a solid, is a cube, whose side is an inch, foot, yard, or other determinate length: in *geometry*, it is a cubic perch, divided into cubic feet, digits, &c. Hence cubic measure or measures of capacity.

MEASURE of velocity, in *projectiles* and *mechanics*, the space passed over by a moving body in any given time. The space therefore must be divided into as many equal parts, as the time is conceived to be divided into: the quantity of space answering to such an article of time, is the measure of the velocity.

Measures then are various, according to the different kinds and dimensions of things measured. Hence arise lineal and longitudinal measure for lines or lengths; square, for areas; and solid or cubic, for bodies and their capacities: all which again are very different in different countries and ages, and even many of them for different commodities. Hence also arise other divisions, of domestic and foreign, ancient and modern, dry and wet (or liquid) measures, &c.

Long MEASURE. The English standard long measure, or that whereby the quantities of

things are ordinarily estimated, is the yard, containing 3 English feet, equal to 3 Paris feet 1 inch and 3-12ths of an inch, or 7-9ths of a Paris ell. Its subdivisions are the foot, span, palm, inch, and barley-corn: its multipliers are the pace, fathom, pole, furlong, and mile.

French standard MEASURE is the aune or ell, containing 3 Paris feet, 7 inches, 8 lines, or 1 yard 2-7ths English; the Paris foot royal exceeding the English by $\frac{61}{1000}$ parts: this ell is divided two ways; namely, into halves, thirds, sixths, and twelfths; and into quarters, half-quarters, and sixteenths. This ell obtains in the greatest part of France, excepting at Troyes, Ares, and some parts of Picardy and Burgundy, where the ell is no more than 2 feet, 5 inches, 1 line; and at St. Genoux, where it exceeds the Paris ell by 8 lines: but at Marseilles, Montpellier, Tholouse in Provence, and Guinne, it contains 5 Paris feet, 5 inches, and 6 lines, or a Paris ell and a half: at Montpellier and the lower Languedoc, in Provence, Avignon, and even Dauphiné, it is a Paris ell and two thirds.

The English foot, to the French royal, is as 107 to 114; and the French toise is equal to 6 feet English, nearly.

Standard MEASURE, in Holland, Flanders, Sweden, a good part of Germany, many of the Hans-towns, Dantzic, and Hambourg, and at Geneva, Frankfort, &c. is likewise the ell, being different in all these parts: in Holland it contains 1 Paris foot, 11 lines, and 4-7ths of the Paris ell: the Flanders ell contains 7-12ths of the Paris ell: the ell of Germany and Brabant, &c. is equal to that of Flanders.

Italian MEASURE, is the braccio, or fathom; which obtains in the states of Modena, Venice, Florence, Lucca, Milan, Mantua, Bologna, &c. At Venice it contains 1 Paris foot, 11 inches, 3 lines, or 8-15ths of the Paris ell: at Bologna, Modena, and Mantua, the same as at Venice: at Lucca it contains $\frac{1}{4}$ a Paris ell; at Florence, $\frac{40}{100}$ of a Paris ell: at Milan the brace for silks is 4-9ths of a Paris ell; and that for woollen cloths, the same as in Holland: at Bergama the brace is 5-9ths of a Paris ell. The usual measure at Naples is the canna, containing $1\frac{1}{17}$ of a Paris ell.

Spanish MEASURE, is the vara, containing $1\frac{1}{24}$ of the Paris ell: but in Castile and Valentia, the measure is the pau, span, or palm; which is used, with the canna, at Genoa. In Arragon, the vara is equal to a Paris ell and a half.

Portuguese MEASURE, is the covado, containing 4-7ths of the Paris ell; and the vara, of which 106 make 100 Paris ells.

Piedmontese

M E A

Piedmontese MEASURE, is the covedos, containing 4-7ths of the Paris ell. In Sicily the measure is the canna, the same with that of Naples.

Muscovite MEASURES, are the cubit, equal to 1 Paris foot, 4 inches, 2 lines; and the arcin, 2 whereof are equal to 3 cubits.

Turkish and Levant MEASURES, are the picq, containing 3-5ths of the Paris ell. The Chinese measure is the cobre, 10 of which are equal to 3 Paris ells. In Persia, and some parts of the Indies, the gueze, of which there are two kinds; the royal gueze, or gueze monkelfer,

M E A

containing 4-5ths of the Paris ell; and the shorter gueze, only 2-3ds of the former. At Goa and Ormus, the measure is the Portuguese vara. In Pegu, and other parts of the Indies, the cando, equal to the Venice ell. At Goa, and other parts, they use a larger cando, equal to 17 Dutch ells. In Siam they use the ken, short of 3 Paris feet by an inch: the ken contains 2 socks, the sock 2 keubs, the keub 12 nions or inches: the nion is equal to 8 grains of rice, that is, about 9 lines. At Camboia, the hafter; in Japan, the tatam; and the span on some of the coasts of Guinea.

English Long MEASURE.

inch													
3	palm												
9	3	span											
12	4	1½	foot										
18	6	2	1½	cubit									
36	12	4	3	2	yard								
45	15	5	3½	2½	1½	ell							
60	20	6⅔	5	3½	1½	1½	pace						
72	24	8	6	4	2	1½	1½	fathom					
198	66	22	16½	11	5½	4	3⅒	2½	pole				
7920	2640	880	660	440	220	176	132	110	40	furlong			
63360	21120	7040	5280	3520	1760	1408	1056	880	320	8	mile		

Jewish Long or Itinerary MEASURES.

cubic						Eng. miles.	paces.	feet.	dec.
400	stadium:					0	0	1.824	
2000	5	Sab. day's journey				0	145	4.6	
4000	10	2	eastern mile			0	729	3.0	
12000	30	6	3	parafang		1	403	1.0	
96000	240	48	24	8	a day's journey	4	153	3.0	
						33	172	4.0	

ME A

digitus transversus

$1\frac{3}{4}$	uncia										0	0	6.7252								
4	3	palmus minor										0	0	0.967							
16	12	4	pes										0	0	2.901						
20	15	5	$1\frac{1}{4}$	palmipes										0	0	11.604					
24	18	6	$1\frac{1}{2}$	$1\frac{1}{3}$	cubitus										0	1	2.505				
40	30	10	$2\frac{1}{2}$	2	$1\frac{2}{3}$	gradus										0	1	5.406			
80	60	20	5	4	$3\frac{1}{2}$	2	passus										0	1	5.01		
10000	7500	2500	625	500	$416\frac{2}{3}$	250	215	stadium										0	4	10.02	
80000	60000	20000	5000	4000	$3333\frac{1}{3}$	2000	1000	8	milliare										120	4	4.5
										967	0	0									

The English standard foot being divided into 1000 equal parts, the other measures will have the proportions to it, which follow.

English foot from the standard at		
Guild-hall	-	1000
Paris royal foot, in the Chatelet		1068
Rhinland foot of Snellius	-	1033
Greek foot	-	1007 $\frac{29}{100}$
Roman foot on the monument of		
Cossutius	-	967
Roman foot of Villalpandus,		
taken from the congius of Vef-		
pasian	-	986
Venetian foot	-	1162
ell of Amsterdam	-	2268
Amsterdam foot	-	942
ell of Antwerp	-	2283
foot of Antwerp	-	946
ell of Leyden, in Holland	-	2260
canna of Naples	-	6880
vara of Almeria, and Gibraltar,		
in Spain	-	2760
Spanish foot	-	1001
Toledo foot	-	899
braccio of Florence	-	1913
palm of Genoa	-	815
common braccio of Sienna	-	1242
braccio of Sienna for linen	-	1974
palm of the architects at Rome,		

whereof 10 make the canna of the same architects	-	732
palm of the braccio for the merchants and weavers at Rome, from a marble in the Capitol, with this inscription, CURANTE LV POETO	-	995 ¹
large pique of the Turks at Constantinople	-	2200
small pique of the Turks at Constantinople is to the larger as 31 to 32		
arish of Persia	-	3197
derah or cubit of the Egyptians		1824
Dort foot in Holland	-	1184
Middleburg foot	-	991
Strasbourg foot	-	920
Bremen foot	-	964
foot of Cologn	-	954
foot of Frankfort on the Main	-	948
Dantzick foot	-	944
foot of Copenhagen	-	965
foot of Prague	-	1026
Riga foot	-	1831
{ Mantua	-	1585
{ Bononia	-	1204
foot of { Mechlin	-	919
{ Stockholm	-	963 ¹
{ Lisbon	-	1005

English square or superficial MEASURES, are raised from the yard of 36 inches multiplied into itself; and this producing 1296 square inches

inches in the square yard, the divisions of this are square feet and inches, and the multipliers, poles, roods, and acres.

English *square* MEASURE.

inches				
144	feet			
1296	9	yards		
3600	25	2	paces	
39204	272½	30½	10,89	poles
1568160	10890	1210	435,6	40 roods
6272640	43560	4840	1743,6	160 4¼ ac.

French square MEASURES, are regulated by 12 square lines in the inch square, 12 inches in the foot, 22 feet in the perch, and 100 perches in the arpent or acre.

Cubical MEASURES, or measures of capacity for liquors. English liquid measures were originally raised from troy weight, it being ordained that 8 pounds troy of wheat, gathered from the middle of the ear, and well dried, should weigh a gallon of wine measure; yet a new weight, viz. the avoirdupoise weight, has been introduced, to which a second standard gallon is adjusted, exceeding the former in the proportion of the avoirdupoise weight to the troy weight. From this latter standard are raised 2 measures, the one for ale, the other for beer.

The sealed gallon at Guildhall, which is the standard for wine, spirits, oil, &c. is supposed to contain 231 cubic inches; yet, by actual experiment made in 1688, before the lord mayor and commissioners of excise, it only contains 224 cubic inches. It was however agreed to continue the common supposed contents of 231: hence, as $12 : 231 :: 14\frac{1}{2} : 281\frac{1}{2}$, the cubic inches in an ale gallon; but, in effect, the ale quart contains $70\frac{1}{2}$ cubic inches; on which principles, the ale and beer gallon will be 282 cubic inches.

Dry MEASURE, is different from both the ale and wine measure, being nearly a mean between both.

According to an act of parliament passed in 1697, every round bushel with a plain and even bottom, being made $18\frac{1}{2}$ inches throughout, and 8 inches deep, is to be accounted a legal Win-

chester bushel, according to the standard in his majesty's exchequer; consequently a corn gallon will contain 268.8 inches, as in the following table.

inches			
2688	gallons		
5376	2	pecks	
21504	8	4½	bushels
172032	64	32	8 quartets

MEASURE of wood for firing, is the cord, being 4 feet high, as many broad, and 8 long: it is divided into 2 half-cords.

MEASURE for horses, is the hand, which by statute contains 4 inches.

Powder MEASURES, made of copper, holding from an ounce to 12 pounds, are very convenient in a siege, when guns or mortars are loaded with loose powder, especially in ricochet-firing, &c.

As powder measures are useful in artillery, being more handy than weights, saving time, &c. we shall insert here some experiments made by professor Muller upon that subject, in 1753, at the royal military academy at Woolwich.

1. A cylinder, whose axis and diameter were 2 inches each, contained 3 ounces and 3 grains, or 51 grains; and as similar cylinders are as the cubes of their axes, we say 51 grains are to 256 grains, or 1 pound, as the cube 8 of 2 inches is to the cube 40.156 of the diameter of a like cylinder holding 1 pound.

2. A cylinder, whose axis and diameter were 4 inches each, held 25 ounces and 10.5 grains, or 410.5 grains: whence 410.5 grains are to 256 grains, as the cube 64 of 4 inches is to 39.912, the cube of the axis of a cylinder holding 1 pound.

3. A cylinder, whose diameter and axis were 6 inches each, held 5 pounds 6 ounces and 6 grains, or 1382 grains: hence $1382 : 256 :: 216 : 40.01$ for the cube required.

4. A two-inch cube held 4 ounces and 1 grain, or 65 grains: and as 452 is to 355, so is the cube 8 of the axis to the content of the cylinder, which therefore is 51.05: hence $65 : 256 :: 8 : 40.117$, the cube of the axis.

5. A six-inch cube held 6 pounds 13 ounces and 13 grains, or 1757 grains: so then $452 : 355 :: 1757 : 1379.944$, or 1380, the content of the cylinder: and if $1380 : 256 :: 216 : 40.07$, this 4th term will be the cube of the

axis

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axis required. Hence a medium of these 5 experiments gives 40.053 cubic inches, whose cube root 3.42 will be the diameter of a cylinder holding a pound of powder.

Diameters and heights of cylindric Powder MEASURES from 1 to 39 ounces.

3	0	1	2	3	4	5	6	7	8	9
0	0	1.357	1.710	1.957	2.154	2.321	2.467	2.596	2.714	2.830
1	2.924	2.963	3.107	3.191	3.271	3.347	3.420	3.490	3.575	3.622
2	3.684	3.744	3.803	3.859	3.915	3.968	4.021	4.072	4.121	4.170
3	4.217	4.263	4.309	4.353	4.397	4.439	4.481	4.523	4.563	4.603

N. B. The logarithm of an ounce is .1326467: the other numbers are found by adding $\frac{1}{8}$ of the number of the logarithm of the number of ounces: thus the number of 8 ounces is found by adding .3010300, $\frac{1}{8}$ of the logarithm of 8 to that of 1 ounce, which gives .4336767 for the logarithm of the number sought, which therefore is 2.714. See the above table.

Diameters and heights of cylindric Powder MEASURES from 1 to 39 pounds.

lb	0	1	2	3	4	5	6	7	8	9
0	0	3.420	4.309	4.932	5.429	5.848	6.214	6.541	6.824	7.114
1	7.368	7.606	7.830	8.041	8.243	8.434	8.618	8.794	8.963	9.126
2	9.283	9.435	9.583	9.726	9.865	10.00	10.13	10.26	10.38	10.51
3	10.63	10.74	10.86	10.97	11.08	11.16	11.29	11.45	11.50	11.60

Diameters of cylindric Powder MEASURES, when the diameter is to the axis as 2 to 3.

3	0	1	2	3	4	5	6	7	8	9
0	0	1.181	1.491	1.710	1.880	2.027	2.155	2.268	2.371	2.472
1	2.554	2.588	2.714	2.788	2.857	2.921	2.988	3.049	3.164	3.184
2	3.218	3.271	3.322	3.371	3.420	3.466	3.513	3.557	3.600	3.643
3	3.684	3.724	3.764	3.802	3.841	3.878	3.915	3.951	3.986	4.021

lb	0	1	2	3	4	5	6	7	8	9
0	0	2.988	3.764	4.308	4.743	5.109	5.428	5.714	5.961	6.215
1	6.436	6.644	6.840	7.024	7.201	7.368	7.529	7.682	7.830	7.972
2	8.109	8.242	8.372	8.496	8.618	8.736	8.849	8.963	9.068	9.181
3	9.286	9.382	9.466	9.583	9.679	9.769	9.769	9.863	10.00	10.13

These diameters are found, if those of the former tables be divided by 1.1447, the cube root of 3-2ds.

MEASURE-angle, a brass instrument to measure angles, either salient or reentrant, for exactly ascertaining the number of degrees and minutes, to delineate them on paper.

MEASURING, } in *military mathematics*,
MENSURATION, } the assuming any certain quantity, and expressing the proportion of other similar quantities to the same; or the determining, by a certain known measure, the precise extent, quantity, or capacity of any thing.

MEASURING, in *general*, constitutes the practical part of geometry: and from the various subjects about which it is conversant, it acquires various names, and constitutes various arts, viz.

See **LONGIMETRY**, **ALTIMETRY**, **LEVELLING**, **GEODESIA**, or **SURVEYING**, **STERIOMETRY**, **SUPERFICIES** and **SOLIDS**, &c.

MEASURING. See **CHAIN**.

MECHANICS, a mixed mathematical science, which considers motion and moving powers, their nature and laws, with the effects thereof, in machines, &c. The word is derived from the Greek *μηχανή*, which signifies the same thing, and derived from *μηχανή*, an instrument or skill. That part which considers motion arising from gravity, is sometimes called statics, in contradistinction from that part which considers the mechanical powers and their application, properly called mechanics.

MECHANICAL, something relating to mechanics.

MECHANICAL philosophy, that which explains the phænomena of nature, and the operations of corporeal things, on the principles of mechanics; namely, the motion, gravity, figure, arrangement, &c. of the parts which compose natural bodies.

MECHANICAL powers, or *machines*, are 6 in number, viz. the lever, the pulley, the wheel and axle, the inclined plane, the wedge and the screw.

They are called mechanical powers, because they increase our power of moving or raising heavy bodies, which are often unmanageable by any human strength, not thus assisted; and of two or more of these all other compound machines are composed.

As the learned Dr. Hamilton, professor of mathematics in the university of Dublin, has lately published a new theory of the mechan-

cal powers, and displayed the principles on which we may best explain their nature and manner of acting; we shall lay before our readers the substance of his ingenious essay in his own words.

“ The many useful instruments, says this able mathematician, that have been so ingeniously invented, and so successfully executed, and the great perfection to which the mechanic arts are now arrived, would naturally incline one to think that the true principles on which the efficacy and operations of the several machines depend, must long since have been accurately explained. But this is by no means a necessary inference; for, however men may differ in their opinions about the true method of accounting for the effects of the several machines, yet the practical principles of mechanics are so perfectly known by experience and observation, that the artist is thereby enabled to contrive and adjust the movements of his engines with as much certainty and success as he could do, were he thoroughly acquainted with the laws of motion, from which these principles may be ultimately derived. However, though an enquiry into the true method of deducing the practical principles of mechanics from the laws of motion, should perhaps not contribute much to promote the progress of the mechanic arts, yet it is an enquiry in itself useful, and in some measure necessary; for, since late authors have used very different methods of treating this science, it may be supposed that no one method has been looked upon as satisfactory, and unexceptionable. I shall therefore wish to contribute towards having this subject treated with more accuracy than has hitherto been done.

“ The most general and remarkable theorem in mechanics is certainly this: that when two weights, by means of a machine, counterpoise each other, and are then made to move together, their quantities of motion will be equal. Now, an equilibrium always accompanying this equality of motions, bears such a resemblance to the case wherein two moving bodies stop each other, that Dr. Wallis, and after him most of the late writers, have thought the cause of an equilibrium in the several machines might be immediately assigned, by saying, that since one body cannot produce in another a quantity of motion equal to its own, without losing its own at the same time; two heavy bodies counteracting each other by means of a machine must continue at rest, when they are so circumstanced that one cannot descend without causing

causing the other to ascend at the same time, and with the same quantity of motion; and, therefore, two heavy bodies, in such cases, must always counterbalance each other. Now this argument would be a just one, if it could properly be said that the motion of the ascending body was produced by that of the descending one; but, since the bodies are so connected that one cannot possibly begin to move before the other, I apprehend, that, if bodies are supposed to move, it cannot be said that the motion of one is produced by that of the other: since whatsoever force is supposed to move, one must be the immediate cause of motion in the other also; that is, both their motions must be simultaneous effects of the same cause, just as if the two bodies were really but one: and, therefore, if I was to suppose, in this case, that the superior weight of the heavier body (which may be in itself much more than able to sustain the lighter) should overcome the weight of the lighter, and produce equal motions in both bodies; I do not think that from thence I could be reduced to the absurdity of supposing, that one body, by its motion, might produce in another a motion equal to its own, and yet not lose its own at the same time. But those who argue from the equality of motions on this occasion say further, that, since the two bodies must have equal motion when they do move, they must have equal endeavours to move even while at rest, and therefore these endeavours to move, being equal and contrary, must destroy each other, and the bodies must continue at rest, and consequently balance each other. In answer to this I must observe, that the absolute force with which a heavy body endeavours to descend from a state of rest, can only be proportionable to its weight; and therefore I think it is necessary, that some cause should be assigned why (for instance in the lever) the endeavour of one pound to descend shall be equal to that of 4 pounds; and especially as the fulcrum on which both weights act requires no greater force to support it than that of 5 pounds.

“From these considerations I infer, that the reason why very unequal weights may balance each other, should be assigned not from their having momenta when made to move together, but by proving *à priori*, without considering their motions, that either the re-action of the fixed parts of the machine, or some other cause, so far takes off from the weight of the heavier body as to leave it only just able to support the lighter. However, as this equality of momenta which always accompanies an equilibrium, affords a

very elegant theorem, it should be taken notice of in every treatise of mechanics, and may serve as an index of an equilibrium. But I would not have it applied to a purpose for which it is unfit; as it has in another instance by Dr. Kiel, who from thence gives the reason why water stands at the same height in a narrow tube and a wide vessel with which it communicates: and an argument of the same kind is applied still more improperly by Dr. Rutherford, and others, to shew why a drop of water included in a small conical tube will move towards the narrower end: and yet the true ways of accounting for both these phenomena are extremely obvious and easy.

“The simple mechanic powers are usually reckoned 6, the lever, axle and wheel, pulley, wedge, inclined plane, and screw. The only method I have met with of explaining the nature of these machines upon one and the same principle, is that which I just now examined; and as that appears to me unsatisfactory, I shall consider the nature of each machine separately, in the order I have set them down.

“The lever is said to be a right line, inflexible and void of weight. Its fundamental property is this: when any two forces act against each other on the arms of a lever, they will continue in equilibrio, if their quantities are inversely as the distances between the points to which they are applied and the point round which the lever turns; which point is called the fulcrum, or prop.

“Several methods have been used, by different authors, to prove, that this property belongs to the lever. We find in the works of Archimedes, a proof brought for this purpose, which has since been made use of by several writers of mechanics; who, I find, have somewhat altered the form of his argument, the subject of which is generally expressed as follows: When a cylinder of any uniform matter is supported at its middle point, it will continue at rest; for all the parts on one side must balance those on the other, being exactly equal to them both in weight and situation; so that the whole weight of this cylinder may be looked upon as acting on the middle point on which it is supported. From whence it follows, that the weight of such a cylinder will act upon whatever supports it, in the same manner as it would do if it was all contracted into the middle point of its axis. If therefore we suppose the cylinder to be distinguished into two unequal cylinders or segments, the distances between the middle points of those segments and the middle of the whole cylinder

cylinder will be inverſely as the lengths of the ſegments; that is, inverſely as their weights: but, as it was ſaid before, the weight of each cylinder acts in the ſame manner as it would do if contracted into the middle point of its axis; and therefore if the weights of thoſe cylinders be contracted into theſe points, they will continue to ſupport each other as before: and thence it is concluded, that any two weights, acting againſt each other on a line ſuſtained at a fixed point, will counterpoize each other, when they are inverſely as the diſtances of the points on which they act, from the point on which the line reſts. To this agreement there ſeems to be a manifeſt objection; for, when the whole cylinder is diſtinguiſhed into two ſegments, part of the weight of the greater ſegment acts on the ſame ſide of the fulcrum with the leſſer ſegment; and therefore when the whole weight of the greater ſegment is contracted into its middle point on one ſide of the fulcrum, and acts all of it againſt the leſſer ſegment, it requires at leaſt ſome proof to ſhew, that this contracted weight will be balanced by the weight of the leſſer ſegment. Mr. Hugenſ, in his miſcellaneous obſervations on mechanics, takes notice of this objection to Archimedes's method, which, he ſays, ſeveral mathematicians had endeavoured to remove, but without ſucceſs. He therefore, inſtead of this method, propoſed one of his own, which depends on a poſtulatium that he uſes in common with Archimedes, and which I think ſhould not be granted on this occaſion: it is this; when equal bodies are placed on the arms of a lever, the one which is furtheſt from the fulcrum will prevail and raiſe the other up. Now, this is taking it for granted, in other words, that a ſmall weight placed further from the fulcrum will ſupport or raiſe a greater one. The cauſe and reaſon of which fact muſt be derived from the demonſtration that follows; and therefore this demonſtration ſhould not be founded on the ſuppoſed ſelf-evidence of what is partly the thing to be proved. But perhaps it may be ſaid, that the poſtulatium may be granted merely on this account; that the centre of gravity of the two bodies (which in this caſe is the middle point between them) is not ſuſtained; and therefore the body, which is on the ſame ſide of the fulcrum with the centre of gravity, will deſcend.

“In answer to which I muſt obſerve, that this property, which the centre of gravity has of deſcending, when not placed directly above or below the point of ſuſpenſion, cannot be

proved to belong to it in any caſe; nor can we even ſhew that there is only one centre of gravity between two bodies joined by a right line, until it is proved in general that the centre of gravity of any two bodies is a point ſo placed between them, that their diſtances from it are inverſely as their weights: but this in effect includes the principal property of the lever, which therefore cannot be proved from any previous ſuppoſition, that the centre of gravity will deſcend, even when the bodies are equal, and we know it is the middle point between them.

“I muſt now proceed to conſider what Sir Iſaac Newton hath delivered on this ſubject in his *Principia*, after the 2d cor. to the 3d law of motion, which Dr. Clarke, (in his notes on Rohault) and all the ſubſequent writers, have quoted as an elegant proof of the property of the lever; and therefore what appears to me at preſent an objection to this proof, I ſhall mention with great diffidence, and in hopes of being ſet right, if I am wrong. Sir Iſaac ſuppoſes two weights, as *A* and *P* (pl. I. fig. 8*) to hang by threads, from the points *M* and *N* in a wheel or circular plane perpendicular to the horizon, and moveable about its centre *O*; and then propoſes to determine the forces with which theſe weights act to turn the wheel round its centre. In order to do this, he ſuppoſes that it is indifferent from what points in the perpendicular lines *MA* and *NP* the weights are hung, for that they will ſtill have the ſame power to turn the wheel about its centre. His words are, *Quoniam nil refert utrum ſilorum puncta K, L, D, affixa ſint vel non affixa ad planum rotæ; pondera idem valebunt ac ſi ſuſpenderentur a punctis K et L, vel D et L.* Now whether the points of the threads *L, I, D*, are fixed or not to the plane of the wheel, is certainly of importance, as it muſt make a difference in the points of ſuſpenſion of the weights, and conſequently in the degrees of obliquity with which the weights act; for the loweſt point of the thread that is fixed to the plane muſt be conſidered as the point from which the weight hangs; as the parts of the thread above that point are quite uſeleſs, not being at all acted upon. And from thence I ſhall endeavour to ſhew, that to ſuppoſe the weight *A* will have the ſame power to turn the wheel from whatever point in the line *MA* it hangs, is in effect preſuppoſing what is intended to be proved. For it appears, from what he ſays immediately after, that, when the weight *A* hangs from the point *D*, if its whole force be expreſſed by the line *AD*,

AD , and be resolved into two forces, DC and AC , the former only will have any effect in turning the wheel, as it acts perpendicularly on the radius OD , while the latter is lost, its direction being parallel to OD . But it is evident, that, when the same weight hangs from the point K , as it acts perpendicularly on the radius OK , its whole force is exerted to turn the wheel, and none of it lost by oblique action.

"Therefore, the force which the weight A , exerts to oppose the weight P , and turn the wheel when it hangs from D , is, to the force it exerts when it hangs from K , as the line DC to AD , or as OK to OD , (sim. triang. ADC , DOK) that is, the forces exerted by the weight A , hanging from the points D and K , are inversely as the radii OD and OK . And therefore to suppose, that these two forces will have the same effect in turning the wheel and opposing the weight P , is the same as supposing that two forces will have equal effects in moving the arms of a lever (on which they act perpendicularly) when they are inversely at the lengths of those arms. But this is the very conclusion Sir Isaac draws from his premises; for he says, *Pondera igitur A et P, quæ sunt reciproce ut radii in directum positi OK, OL, idem pollebunt et sic consistent in æquilibrio, quæ est proprietas notissima libræ, velis et axis in peritrochio*. But further, this property of the lever, which is here expressed in general terms, includes two cases; for the arms of the lever may be either perpendicular or oblique to the directions of the weights. The first of these cases is the simplest, and should be first demonstrated: and I do not see how there can be any room for applying the resolution of forces in demonstrating this case, in which no part of any weight is lost by oblique action. But when this case is proved, we have from thence, by the resolution of forces, an easy way of shewing, in the second case, when the arms of the lever are oblique to the directions of the weights, that the weights will counterbalance each other, when they are reciprocally as the perpendicular distances of their lines of direction from the centre of motion. From the last of these cases, we may deduce an obvious reason why the weight A should have the same power to turn the wheel, from whatever point it hangs in the line MA ; the truth of which, I am persuaded, cannot be proved independent of those cases, and therefore think it should not be used as a postulatam in demonstrating the general property of the lever.

"Mr. Maclaurin, in his view of Newton's Phi-

losophy, after giving us the methods which Archimedes and Newton have used for proving the fundamental property of the lever, proposes one of his own, which, he says, appears to be the most natural one for this purpose. However, as to his method I shall only observe, that, from equal bodies sustaining each other at equal distances from the fulcrum, he shews us how to infer that a body of one pound (for instance) will sustain another of two pounds at half its distance from the fulcrum; and from thence that it will sustain one of three pounds at a third of its distance from the fulcrum: he goes on, declaring, by a kind of induction, what the proportion is in general between two bodies that sustain each other on the arms of the lever. But this argument, he observes, cannot be applied when the arms of the lever are incommensurable; and therefore it cannot conclude generally, and consequently is imperfect.

"These are the methods of demonstrating the fundamental property of the lever, which are worth taking notice of; and, since they seem liable to exceptions, and the other methods I have met with are still more exceptionable, I shall propose a new proof of this property of the lever, which appears to me a very simple one, and depends on a postulatam that, I believe, will be readily granted.

"If a force be universally diffused over a right line, that is, if an equal part of the force acts upon every point of the line, and if the whole force acts according to one and the same plane; this force will be sustained, and the line kept in equilibrium, by a single force applied to the middle point of the line equal to the diffused force, and acting in a contrary direction.

"In order to shorten the following proof, I must premise, by way of lemma, that, if a right line be divided into two segments, the distance between the middle of the whole line, and the middle points of the segments, will be inversely as the segments. This is self-evident when the segments are equal; and, when they are unequal, then, since half of the whole line is equal to half of the greater and half of the lesser segment, it is plain that the distance between the middle of the whole line and the middle of one segment must be equal to half of the other segment, so that these distances must be to each other inversely as the segments; all which appear evident from the inspection of fig. 9.

"Let now the line GH , (fig. 10.) whose middle point is D , be divided into unequal segments GL , and LH , whose middle points are C and F , and let two forces or weights A and

and B , which are to each other as the segments GL and LH , be applied to their middle points C and F , and let them act perpendicularly on the line GH . Then (by the lemma) the weight A and B will be to each other inversely as CD , and FD , (the distances of the points C and F , to which they are applied from the middle of the whole line): if then a third force or weight E , equal to the sum of the forces A and B , be applied to the point D , and acts on the line in an opposite direction; I say, then, these three forces will sustain each other, and keep the line in equilibrio. For let us suppose the force E to be removed, and instead of it another force, equal also to the sum of A and B , to be uniformly diffused over the whole line GH , and to act directly against the forces A and B , then the part of this force which acts on the segment GL , will be equal to the force A , and therefore will be sustained by it (*postulatum*); and the other part, which is diffused over the segment LH , will be equal to and sustained by the force B , so that the forces A and B will sustain this diffused force, and keep the line in equilibrio. Let now two other forces act also on this line in opposite directions, one of them the force E acting on the point D , as it was first supposed to do, and the other an uniformly diffused force equal to E (and consequently equal to the other diffused force): then these two additional forces will also balance each other, and therefore the equilibrium will still remain: so that the two forces A and B , and a diffused force acting on one side of the line, sustain the force E and a diffused force acting on the other side: but it is manifest, that in this equilibrium, the two diffused forces acting on opposite sides are perfectly equivalent; and therefore, if they are taken away from both sides, the equilibrium must still remain. Hence it appears, that the three weights or forces A , B , and E , any two of which are (by the construction) to each other inversely as their distances from the third, will sustain each other, and keep the line on which they act in equilibrio; which is the first and most simple case of the property of the lever; for here the directions of the weights are supposed to be perpendicular to the line on which they act; and it is evident that, if one of the points C , D , or F , be fixed or considered as a fulcrum, the weights acting on the other two points will continue to support each other.

"I shall not now take the trouble of proving the second case of the second property of the lever: it is most easily deduced from the first;

for when two weights act on the arms of a lever in oblique directions, and are to each other inversely as the perpendicular distances of their lines of direction from the centre of motion, then, by the revolution of forces, it is easily proved that the parts of those forces which act perpendicularly on the arms of the lever, and which only are exerted to turn the lever, are to each other inversely as the lengths of those arms; and therefore by the first case they must balance each other.

"I shall now mention some well-known truths in mechanics, which, I think, cannot be proved otherwise than by deducing them from what hath been here demonstrated.

"*Corollary 1.* It appears from hence, that the powers with which any two forces move or endeavour to move the arms of a lever, are as the rectangles, under lines proportional to the forces, and the perpendicular distances of their lines of direction from the fulcrum.

"*Cor. 2.* When therefore two bodies acting on the arms of a lever sustain each other, if one of them be removed farther from the fulcrum, it will preponderate; but if it be brought nearer to the fulcrum, the other weight will prevail; because the product to which its force is proportionable will be increased in the first case, and diminished in the second.

"*Cor. 3.* We learn from hence to find out the centre of gravity of any two bodies joined by an inflexible right line, and to prove that its definition will agree to one point only in the line. For if a point be taken in the line, so that the distances of the bodies from it may be inversely as their weights, that point will be the centre of gravity; because, when it is sustained, the bodies will be in equilibrio. But if the line is sustained at any other point, then is the fulcrum removed further from one body, and brought nearer to the other, than it was when the bodies balanced each other; and therefore, by preceding *Cor.* that body from which it is removed, or which is on the same side with the centre of gravity, will descend: consequently there is but one point in the line, which being sustained, the bodies will be in equilibrio, and therefore but one point only can be their centre of gravity. Hence also it appears, that the centre of gravity will always descend, when it is not directly above or below the point by which the body is sustained.

"I shall now endeavour to be as concise as possible in what I have to say of the other mechanic powers; having, I fear, been too tedious in my account of the lever, which, however,

ever, deserves to be particularly considered, since to it may be reduced the balance, the axle and wheel, and (according to some writers) the pully.

“ The balance I do not consider as a distinct machine, because it is evidently no other than a lever fitted to the particular purpose of comparing weights together; and does not serve for raising weights, or overcoming resistances, as the other machines do.

“ When a weight is to be raised by means of an axle and wheel, it is fastened to a cord that goes round the axle; and the power, which is to raise it, is hung to a cord that goes round the wheel. If then the power be to the weight as the radius of the axle to the radius of the wheel, it will just support that weight; as will easily appear from what was proved of the lever. For the axle and wheel may be considered as a lever, whose fulcrum is a line passing through the centre of the wheel and middle of the axle, and whose long and short arms are the radii of the wheel and axle, which are parallel to the horizon, and from whose extremities the cords hang perpendicularly. And thus an axle and wheel may be looked upon as a perpetual lever, on whose arms the power and weight always act perpendicularly, though the lever turns round its fulcrum. And in like manner, when wheels and axles move each other by means of teeth on their peripheries, such a machine is really a perpetual compound lever: and, by considering it as such, we may compute the proportion of any power to the weight it is able to sustain by the help of such an engine. And since the radii of two contiguous wheels, whose teeth are applied to each other, are as the number of teeth in each, or inversely as the number of revolutions which they make in the same time; we may, in the computation, instead of the ratio of these radii, put the ratio of the number of teeth on each wheel, or the inverse ratio of the number of revolutions they make in the same time.

“ Some writers have thought the nature and effects of the pully might be best explained by considering a fixed pully as a lever of the first, and a moveable pully as one of the second kind. But though the pully may bear being considered in that light, yet, I think, the best and most natural method of explaining its effects (that is, of computing the proportion of any power to the weight it can sustain by means of any system of pullies) is, by considering that every moveable pully hangs by two ropes, equally stretched, which must bear equal parts of the

weight; and therefore, when one and the same rope goes round several fixed and moveable pullies, since all its parts on each side of the pullies are equally stretched, the whole weight must be divided equally amongst all the ropes by which the moveable pullies hang: and consequently, if the power which acts on one rope be equal to the weight divided by the number of ropes, or double the number of moveable pullies, that power must sustain the weight.

“ Upon this principle, the proportion of the power to the weight it sustains by means of any system of the pullies, may be computed in a manner so easy and natural as must be obvious to every common capacity.

“ The proportion which any power bears to the resisting force it is able to sustain by means of a wedge, has been laid down differently by different authors, as they happened to consider it in particular cases. Without examining their several opinions, I shall endeavour to express this proportion in one general proposition, which may extend to the several cases in which the wedge is applied.

“ Let the equicrural triangle ABC , (*fig. 10.*) represent a wedge: the lines AB and CB will be the sides of the wedge, AC its base or back, and its height will be the line PB bisecting the base AC , and also the vertical angle ABC . When any two resisting forces act on the sides of a wedge in directions which make equal angles with the sides (as they are always supposed to do) a power acting perpendicularly at P , on the base of the wedge, will keep the resisting forces in equilibrio, when it is to the sum of these forces, as the sine of half the vertical angle of the wedge, to the sine of the angle which the directions of the forces contain with the sides of the wedge.

“ For let E and F be two bodies acting on the sides of the wedge, and let them be first supposed to act in the directions EP and FP perpendicular to the sides; then since the power P acts perpendicularly on the base AC , if these three forces keep the wedge in equilibrio, they will be to each other as the sides of a triangle, to which their directions are parallel, or (which is the same thing) as the sides of the triangle ABC , to which their directions are perpendicular. Therefore the power P , is to the sum of the resisting forces which it sustains, as AC the base of the wedge to the sum of the sides, or as PA , $\frac{1}{2}$ the base, to AB one of the sides; but PA is to AB as the sign of PBA , $\frac{1}{2}$ the vertical angle of the wedge, to the radius which is the sign of a right

right angle, and the directions of the resisting forces are supposed in this case to contain a right angle with the sides of the wedge.

“ Let now the resisting bodies E and F be supposed to act on the wedge in directions parallel to the lines DP and OP , which make oblique angles with its sides: draw EG and FK perpendicular to those lines. From what has been proved it appears, that the power P is to the force with which it is able, by means of the wedge, to protrude the resisting bodies in the directions PE and PF , as the sine of $\frac{1}{2}$ the vertical angle to the radius: let this protruding force be expressed by the line PE , and let it be resolved into two forces expressed by the lines PG and GE : the former of these only will act in opposition to the resisting bodies; therefore the whole protruding force of the power is, to the force with which it acts against the resisting bodies PE and PF in the directions PD and PO , as PE to PG , or (because the triangles EPG and DPE are similar) as PD to PE , that is, as the radius to the sine of the angle PDE ; compounding therefore the ratio of the sine of $\frac{1}{2}$ the vertical angle to the radius, with the ratio of the radius to the sine of the angle PDE , the power P , when the wedge is kept in equilibrio, will be, to the force with which it protrudes the resisting bodies in directions opposite to those in which they act, as the sine of $\frac{1}{2}$ the vertical angle to the sine of the angle PDE or POE , which the directions of the resisting forces contain with the sides of the wedge.

“ Hence, when the directions in which the resisting bodies act on a wedge are given, we may easily find two lines that will express the proportion between the resistance and the power which sustains it by means of the wedge. For from P , the middle point of the wedge, draw the line PD meeting one of the sides, and parallel to the direction in which the resisting force acts on that side, then the power will be to the resistance as PD to PB , the height of the wedge. For PD and PB are to each other as the lines of the opposite angles, in the triangle PBD , that is, as the lines of $\frac{1}{2}$ the vertical angle, and the angle which the direction of the resisting force contains with the sides of the wedge.

“ From what hath been demonstrated we may deduce the proportion of the power to the resistance it is able to sustain in all the cases in which the wedge is applied. First, when in cleaving timber the wedge fills the cleft, then

the resistance of the timber acts perpendicularly on the sides of the wedge; therefore, on this case, when the power which drives the wedge, is to the cohesive force of the timber, as $\frac{1}{2}$ the base to one side of the wedge, the power and resistance will be in equilibrio.

“ Secondly, when the wedge does not exactly fill the cleft, which generally happens because the wood splits to some distance before the wedge. Let ELF represent a cleft, into which the wedge ABC is partly driven: as the resisting force of the timber must act on the wedge in direction perpendicular to EL , the side of the cleft, and meeting the side of the wedge in D ; then the power driving the wedge, and the resistance of the timber, when they balance, will be to each other as the line PD to PB , the height of the wedge.

“ Thirdly, when a wedge is employed to separate two bodies that lie together on an horizontal plane, for instance, two blocks of stone; as these bodies must recede from each other in horizontal directions, their resistance must act on the wedge in lines parallel to its base CA ; therefore the power that drives the wedge will balance the resistance when they are to each other as PA , $\frac{1}{2}$ the breadth of the wedge, to PB , its height; and then any additional force, sufficient to overcome the resistance arising from the friction of the bodies on the horizontal plane, will separate them from each other.

“ The inclined plane is reckoned by some writers among the mechanic powers; and I think with reason, as it may be used with advantage in raising weights.

“ Let the line AB (fig. 11.) represent the length of an inclined plane, AD its height, and the line BD we may call its base. Let the circular body GEF be supposed to rest on the inclined plane, and to be kept from falling down it by a string CS tied to its centre C . Then the force with which this body stretches the string will be to its whole weight, as the sine of ABD , the angle of elevation, to the sine of the angle which the string contains with a line perpendicular to AB , the length of the plane. For let the radius CE be drawn perpendicular to AB , and from E draw EO parallel to the string, and meeting CF in O ; then, as the body continues at rest, and is urged by three forces, to wit, by its weight in the direction CE , by the reaction of the plane in the direction EO ; the reaction of the string; or the force by which it is stretched, is to the

the weight of the body, as EO to CE ; that is, as the sine of (the angle ECO , which is equal to) ABD , the angle of elevation, to the sine of the angle EOC , equal to SCO , the angle which the string contains with the line CF perpendicular to AB , the length of the plane.

“When therefore the string is parallel to the length of the plane, the force with which it is stretched, or with which the body tends down the inclined plane, is, to its whole weight, as the sine of the angle of elevation, to the radius, or as the height of the plane to the length. And in the same manner it may be shewn, that when the string is parallel to BD , the base of the plane, the force with which it is stretched is, to the weight of the body, as AD to BD ; that is, as the height of the plane is to its base. If we suppose the string, which supports the body GEP , to be fastened at S , and that a force, by acting on the line AD , the height of the plane, and in a direction parallel to the base BD , drives the inclined plane under the body, and by that means makes it rise to a direction parallel to AD : then, from what was proved in the third case of the wedge, it will appear, that this force must be to the weight of the body, as AD to BD , or rather in a proportion somewhat greater; if it makes the plane move on, and the body rise.

“From this last observation we may clearly shew the nature and force of the screw; a machine of great efficacy in raising weights, or in pressing bodies closely together. For if the triangle ABD be turned round a cylinder whose periphery is equal to BD , then the length of the inclined plane BA will rise round the cylinder in a spiral manner, and from what is called the thread of the screw; and we may suppose it continued in the same manner round the cylinder from one end to the other; and AD the height of the inclined plane will be every where the distance between two contiguous threads of the screw, which is called a convex screw: and a concave screw may be formed to fit this exactly, if an inclined plane, every way like the former, be turned round the inside of a hollow cylinder, whose periphery is somewhat larger than that of the other. Let us now suppose the concave screw to be fixed, and the convex one to be fitted into it, and a weight to be laid on the top of the convex screw: then, if a power be applied to the periphery of this convex screw to turn it round, at every

revolution the weight will be raised up through a space equal to the distance between the two contiguous threads; that is, to the line AD the height of the inclined plane BA ; therefore, since the power applied to the periphery acts in a direction parallel to BD , it must be to the weight it raises as AD to BD , or as the distance between two contiguous threads, to the periphery of the convex screw.

“The distance between two contiguous threads is to be measured by a line parallel to the axle. If we now suppose that a hand-spike or handle, which is inserted into the bottom of the convex screw, and that the power which turns the screw is applied to the extremity of this handle, which is generally the case; then, as the power is removed farther from the axis of motion, its force will be so much increased (*vide* what was said of the lever, *Cor. 1.*) and therefore so much may the power itself be diminished: so that the power, which, acting on the end of a handle, sustains a weight by means of a screw, will be to that weight, as the distance between two contiguous threads of the screw, to the periphery described by the end of the handle. In this case we may consider the machines as composed of a screw and a lever, or, as Sir Isaac Newton expresseth it, *Cuneus à velle impulsus.*”

Of any two or more of these simple machines combined together, all other machines, however complicated, are composed; and their powers and manner of acting may thereby be explained from the principles here laid down.

MECHANICAL, in *mathematics*, denotes a construction of some problem, by the assistance of instruments, as the duplicature of the cube, and quadrature of the circle, in contradistinction to that which is done in an accurate and geometrical manner.

MEDICINE-CHEST, is composed of all sorts of medicines necessary for a campaign, together with such chirurgical instruments as are useful, fitted up in chests, and portable.

MEMOIRS, in *military matters of literature*, a species of history, written by persons who had some share in the transactions they relate, answering, in some measure, to what the Romans call *commentarii*, i. e. commentaries.

MENSURATION, in *general*, denotes the act or art of measuring lines, superficies and solids.

MERIT,

M E

MERIT, in a *military sense*, signifies promotion in the army according to merit, and not by purchase or interest.

MERLON, in *fortification*, that part of the parapet which is terminated by 2 embrasures of a battery, so that its height and thickness are the same with those of the parapet. It serves to cover those on the battery from the enemy, and is better when made of earth, well rammed and beat close, than of stone, because these fly about, and wound those it should defend.

MESS, in a *military sense*, implies a number of soldiers who, by laying away a certain moiety of their pay towards provisions, mess together: 6 or 8 is generally the number of each mess. Experience proves that nothing contributes more to the health of a soldier, than a regular and well-chosen diet, and his being obliged every day to boil the pot; it corrects drunkenness, and, in a great measure, prevents gaming, and thereby desertion.

METAL, a hard, shining, mineral body, fusible by fire, congealable by cold, ductile, and capable of being amalgamated or intimately united to quicksilver.

Gun-METAL, a composition of tin and copper. The most common proportion is, to 100 pounds of copper 12 pounds of tin: the founders will sometimes vary from this proportion, according to the hardness of the copper.

MILE, in *geography*, a long measure, whereby the English, &c. use to express the distance between places: it is of different extent in different countries. The geometrical mile contains 1000 geometrical paces, *mille passus*, from whence miles are denominated.

We shall here give a table of the miles in use among the principal nations of Europe, in geometrical paces, 60,000 of which make a degree of the equator.

		Geometrical paces	
Mile of	Russia	-	750
	Italy	-	1000
	England	-	1200
	Scotland and Ireland	-	1500
The { old small great	league of France	{	1500
		{	2000
		{	3000
		{	3000
Mile of	Poland	-	3000
	Spain and Portugal	-	3428
	Germany	-	4000
	Sweden	-	5000
	Denmark	-	5010
	Hungary	-	6000
	Holland	-	3500

MILITARY, something belonging to the soldiery or militia, &c.

MILITARY architecture, the same with fortification. See **FORTIFICATION**.

MILITARY ways, the large Roman roads which Agrippa procured to be made through the empire in Augustus's time, for the marching of troops and conveying of carriages. They were paved from the gates of Rome to the utmost limits of the empire.

MILITARY discipline. Next to the forming of troops, military discipline is the first object that presents itself to our notice: it is the soul of all armies; and unless it be established amongst them with great prudence, and supported with unshaken resolution, they are no better than so many contemptible heaps of rabble, which are more dangerous to the very state that maintains them, than even its declared enemies. See **DISCIPLINE**.

MILITARY execution, the ravaging or destroying of a country or town that refuses to pay the contribution inflicted upon them.

MILITARY first principles, is the bodily training for a soldier, to make him hardy and robust, capable to maintain health amidst fatigue, bad weather and change of climate; to march at such possible pace, and for such length of time, and with such burden, as, without training, he would not be able to do.

MILITIA, in *general*, denotes the body of soldiers, or those who make profession of arms.

In a more restrained sense, militia denotes the trained-bands of a town or country, who arm themselves, upon a short warning, for their own defence; so that, in this sense, militia is opposed to regular or stated troops.

For the direction and command of the militia, the king constitutes lords-lieutenants of each county.

MILL, properly denotes a machine for grinding corn, &c. but more generally it denotes all such machines whose action depends upon a circular motion. There are various kinds, though foreign to this work.

Gun-powder MILL, is that used for pounding and beating together the ingredients of which gunpowder is composed. See **GUN-POWDER**.

These ingredients being duly proportioned, and put into the mortars of the mills, which are hollow pieces of wood, each capable of holding 20 pounds of paste, are incorporated by means of the pestle and spindle. There are 24 mortars in each mill, where are made each day

M I N E

day 480 pounds of gunpowder, care being taken to sprinkle the ingredients in the mortars with water, from time to time, lest they should take fire. The pestle is a piece of wood 10 feet high, and $4\frac{1}{2}$ inches broad, armed at bottom with a round piece of metal. It weighs about 65 pounds.

MINE, in a *military sense*, implies a subterraneous passage dug under the wall or rampart of a fortification, with a design of blowing it up by gunpowder.

Counter-MINES, are those made by the besieged, whereas mines are generally made by the besiegers. Both mines and counter-mines are made in the same manner, and for the like purposes, viz. to blow up their enemies and their works; only the principal galleries and mines of the besieged, are usually made before the town is besieged, and frequently at the same time the fortification is built, to save expence.

MINING, in the *art of war*, is become one of the most essential parts of the attack and defence of places: so much artillery is used, that nothing above ground can withstand its effects; the most substantial ramparts and parapets can resist but a short time; the outworks, though numerous, serve only to retard, for a time, the surrender of the place.

History informs us that mines were made long before the invention of gunpowder; for the ancients made galleries or under-ground passages, much in the same way as the moderns, from without, under the walls of the places, which they cut off from the foundation, and supported them with strong props: then they filled the intervals with all manner of combustibles, which being set on fire burnt their props, and the wall being no longer supported fell, whereby a breach was made.

The besieged also made under-ground passages from the town under the besieger's machines, by which they battered the walls, to destroy them; which proves necessity to be the inventor of mines, as well as of other useful arts.

The first mines, since the invention of gunpowder, were in 1487, by the Genoese, at the attack of Serezanella, a town in Florence; but these failing, they were for some time neglected, till Peter Navarro, being then engineer to the Genoese, and afterwards to the Spaniards in 1503, against the French, at the siege of the castle del Ovo, at Naples, made a mine under the wall, and blew it up, and the castle was taken by storm.

Mr. Valliere relates the same story, but differs in the name of the engineer: he says it was Francis George, an Italian, who, serving at Naples in quality of architect, proposed to Peter Navarro, the Spanish governor, to take this castle by mines.

Definitions of MINES. A mine is a subterraneous cavity made according to the rules of art, in which a certain quantity of powder is lodged, which by its explosion blows up the earth above it.

1. It has been found by experiments that the figure produced by the explosion is a *paraboloid* $ABCD$ (Pl. VII. fig. 6.) and that the centre of the powder, or charge, occupies the *focus* F .

2. The place where the powder is lodged is called the *chamber* of the mine, or *fourneau*.

3. The passage leading to the powder is called the *gallery*.

4. The line FC drawn from the centre F of the chamber, perpendicular to the nearest surface AB of the ground, is called the line of least resistance.

5. The pit or hole ADB , made by springing the mine, is called the *excavation*; also AB is the *diameter*, and CB the *radius* thereof.

6. The fire is communicated to the mines by a pipe or hose, made of coarse cloth, whose diameter is about $1\frac{1}{4}$ inch, called a *saucisson*, (for the filling of which near half a pound of powder is allowed to every foot) extending from the chamber to the entrance of the gallery, to the end of which is fixed a match, that the miner who sets fire to it may have time to retire, before it reaches the chamber.

7. To prevent the powder from contracting any dampness, the saucisson is laid in a small trough, called an *auget*, made of boards $3\frac{1}{2}$ inches broad, joined together lengthwise, with straw in it, and round the saucisson, with a wooden cover nailed upon it.

<p>Foyer, Focus, or Centre of the Chamber.</p>	}	<p>Some authors call the end of the saucisson that comes within the work, and which is to be set fire to, the foyer, or focus; but by most people, this is generally understood to be the centre of the chamber.</p>
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Galleries and chambers of MINES. Galleries made within the fortification, before the place is attacked, and from which several branches are carried to different places, are generally 4 or $4\frac{1}{2}$ feet wide, and 5 or $5\frac{1}{2}$ feet high. The earth is supported from falling in by arches and walls,

walls, as they are to remain for a considerable time; but when mines are made to be used in a short time, then the galleries are but 3 or 3½ feet wide, and 5 feet high, and the earth supported by wooden frames or props.

The gallery being carried on to the place where the powder is to be lodged, the miners make the chamber, which is generally of a cubical form, large enough to hold the wooden box, which contains the powder necessary for the charge: the box is lined with straw and sand-bags, to prevent the powder from contracting dampness.

The chamber is sunk something lower than the gallery, if the soil permits; but where water is to be apprehended, it must be made higher than the gallery; otherwise the besieged will let in the water, and spoil the mine.

Quantities of powder to charge MINES. Before any calculation can be made of the proper charge for a mine, the density and tenacity of the soil it is to be made in must be ascertained, either by experiment, or otherwise; for, in soils of the same density, that which has the greatest tenacity, will require the greatest force to separate its parts. The density is determined by weighing a cubic foot (or any certain quantity) of the soil; but the tenacity can only be determined by making a mine. The following table contains experiments in 6 different soils, which may be of some assistance to form a judgement of the nature of the soil, when an actual experiment cannot be had.

Nature of the soil	Density	Tenacity
	Weight of 1 cubic foot	Quant. of powder to raise 1 cubic fathom
1. Loose earth or sand	95 pds.	8 pds.
2. Common light soil	124	10
3. Loam, or strong soil	127	11½
4. Potter's clay, or stiff soil	135	13½
5. Clay, mixed with stones	160	16
6. Masonry	205	21½

All the requisites in mining may be determined by the following problems, which admit of 4 cases; for any 3 of the articles below being given, the 4th may thence be found.

1. } The { nature of the soil;
2. } { diameter of the excavation;
3. } { line of least resistance;
4. } { charge.

PROBLEM I.

Given the nature of the soil, the diameter of the excavation, and the line of least resistance, to find the charge.

RULES.

1. To the square of the diameter of the excavation, add the square of double the line of least resistance, and reserve the said sum.
2. Multiply the square root of the reserved sum by double the line of least resistance, and subtract the product from the same sum.
3. Multiply half the remainder by the line of least resistance, and 1.57 times the product, will give the solidity of the excavation.
4. The charge will then be determined from the nature of the soil, as in the following example.

EXAMPLE I.

It is required to make a mine in the second sort of soil, mentioned in the foregoing experiments, which shall have a line of least resistance of 10 feet, and the diameter of its excavation 20 feet: what will be the proper charge?

The nature of this soil, by the table, requires 10 pounds of powder to 216 cubic feet.

CALCULATION.

1. The diameter of the excavation is 20, and its square - - - 400
Double the line of least resistance is 20, and its square - - - 400
Therefore the sum to be reserved is - 800
2. The square root of 800 is 28.3 }
Double the line of least resistance is 20 } 566
Which leaves the remainder - 234
3. Half the remainder is - - - 117
Which, multiplied by the line of least resistance, - - - 10
Gives the product - - - 1170
Which multiplied by - - - 1.57
Gives the solidity of the excavation - - - feet. 1836.9
4. If

M I N

feet. lb. feet. lb.
4. If 216 : 10 :: 1836.9 : 85, which is the charge required.

By Logarithms.

1. Diam. of excav. is = 20 1.301030
Diameter squared is 2.602060 400
Double the line of least resistance is = 20 and its square 400
The sum to be reserved is 2.903090 800
2. Square root of sum is 28.3 1.451545
Double the line of least resistance is = 20 1.301030
Product to be subtracted is 2.752575 566
Remainder is - - 2.369216 234
Line of least resist. = 10 1.000000
10 pounds of powder 1.000000
To 216 cubic feet, *compl. arith.* 7.665546
To which add the *constant log.* 9.894870

And the sum is the logarithm charge required - - 1.929632 = 85 lb.

PROBLEM II.

Given the nature of the soil, the line of least resistance, and the charge, to find the diameter of the excavation.

RULES.

1. Find the solidity of the earth to be raised, by a proportion from the nature of the soil, and multiply it by 1.27. Divide the product by the line of least resistance, and to the quotient add the square of the line of least resistance: reserve the sum.

2. Multiply the square root of the sum reserved by twice the line of least resistance, and add the product to the said sum, and from the result subtract 3 times the square of the line of least resistance; so will the square root of the remainder be the diameter of the required excavation.

EXAMPLE I.

Let a mine be charged with 100 pounds of powder, in a soil which requires 11 pounds of powder to raise 216 cubic feet, and let its line of least resistance be 10 feet: what will be the diameter of the excavation?

By the nature of the soil 11 lb. : 216 feet

M I N

:: 100 lb. : 1964 feet, which is the solidity of the earth to be raised.

1. Therefore multiply - - 1964
By - - - - 1.27

The product is - - - 2494.28

Which divided by the line of least resistance, 10, is - - 249.428

To which add the square of the line of least resistance - - 100.000

And the sum to be reserved is - 349.428

2. The square root of 349.428 is 18.7, which, multiplied by twice the line of least resistance, 20, gives 374.

This added to the sum reserved gives 723.428
From which subtract 3 times the square of least resistance - 300.

And there will remain - - 423.428

The square root of which is, 20.5 feet, being the required diameter of the excavation.

By Logarithms.

	Numb.	Logar.	Numb.
Cubic feet = 216	2.334454		
Powder 11 lb. <i>co. ar.</i>	8.958607		
Charge = 100	2.000000		
Line of least resist. 10 <i>co. ar.</i>	9.000000		
Constant logarithm	0.103804		
	2.396865		249.4

To which add the square of line of least resistance 100.0

Sum to be reserved is 2.543323 349.4

Half of which logar. is 1.271661
Twice line of least resist. 20, 1.301030

Product to be added is 2.572691 373.8

The result is - - 723.2
From which subtract thrice the square of the line of least resistance 300.0

And there remains 2.626546 423.2

Half of which logar. is 1.313273 20.57
feet, the diameter of the excavation required.

Demonstration by Algebra.

Let the diameter of excavation (*fig. 6.*) $AB = d$;

$= d$; the line of least resistance $FC = l$, the parameter $= p$, and $n = 1.57$; also the solid $AEGB = s$. Then will $DC = l + \frac{p}{4}$, and $p \times l + \frac{p^2}{4} = \frac{d^3}{4}$, by the nature of the parabola; therefore $d = \sqrt[3]{p \times 4l + p^2}$.

Also $n \times l + \frac{p}{4} \times \frac{d^2}{4} =$ the solid $ADB = np \times l + \frac{p^3}{16}$, and $\frac{np^3}{16} =$ the solid EDG ; and the difference of these gives the solid $AEGB = np \times l + \frac{p}{4} \times \frac{d^2}{4} - \frac{np^3}{16} = s = np \times l^2 + \frac{pl}{2}$; from whence $p = \sqrt{l^2 + \frac{2s}{nl}} - l$, and $4l + p = 3l + \sqrt{l^2 + \frac{2s}{nl}}$, but $d = \sqrt[3]{p \times 4l + p^2} = \sqrt[3]{l^2 + \frac{2s}{nl} - l^2 \times \frac{2s}{nl} + \sqrt{l^2 - 3l^2}}^{\frac{3}{2}} = 2l \sqrt[3]{\frac{2s}{nl} + l^2 + \frac{2s}{nl} + l^2 - 3l^2}^{\frac{3}{2}}$, which is the rule to problem II. by putting 1.27 for its equal $\frac{2s}{n}$.

Again, $s = np \times l + \frac{p^2}{2}$, as above; and $d^2 = 4pl + p^2$, from whence $p = \sqrt{4l^2 + d^2} - 2l$, which substituted for its value above, gives $s = nl \times \sqrt{4l^2 + d^2} - 2l \times l + \sqrt{4l^2 + d^2} - 2l = \frac{nl}{2} \times 4l^2 + d^2 - 2 - 2l \sqrt{4l^2 + d^2}$, which is the rule to problem I.

Loading and stopping of MINES. The gallery and chamber being ready to be loaded, a strong box of wood is made of the size and figure of the chamber, being about 1-3d or 1-4th bigger than is required for containing the necessary

quantity of powder: against the sides and bottom of the box is put some straw; and this straw is covered over with empty sand-bags, to prevent the powder from contracting any dampness: a hole is made in the side next the gallery, near the bottom of the saucisson to pass through, which is fixed to the middle of the bottom, by means of a wooden peg, to prevent its loosening from the powder; or that, if the enemy should get to the entrance, they may not be able to tear it out. This done, the powder is brought in sand-bags, and thrown loose in the box, and covered also with straw and sand-bags; upon this is put the cover of the box, pressed down very tight with strong props; and, to render them more secure, planks are also put above them, against the earth, and wedged in as fast as possible.

This done, the vacant spaces between the props are filled up with stones and dung, and rammed in the strongest manner: the least neglect in this work will considerably alter the effect of the mine.

Then the auget is laid from the chamber to the entrance of the gallery, with some straw at the bottom; and the saucisson laid in it, with straw over it: lastly, it must be shut with a wooden cover nailed upon it. Great care must be taken, in stopping up the gallery, not to press too hard upon the auget, for fear of spoiling the saucisson, which may hinder the powder from taking fire, and so prevent the mine from springing. The gallery is stopped up with stones, earth and dung, well rammed, 6 or 7 feet further from the chamber than the length of the line of least resistance.

Table for the charge of MINES, according to Valliere.

Length of the line of least resistance	Charge of powder	Length of the line of least resistance	Charge of powder	Length of the line of least resistance	Charge of powder	Length of the line of least resistance	Charge of powder
feet	lb. oz.	feet	lb. oz.	feet	lb. oz.	feet	lb. oz.
1	0 2	12	162 0	23	1140 10	34	3680 12
2	0 12	13	205 15	24	1296 0	35	4019 8
3	2 8	14	257 4	25	1558 9	36	4374 0
4	6 8	15	316 4	26	1647 12	37	4748 11
5	11 11	16	384 0	27	1815 4	38	5144 4
6	20 4	17	460 9	28	2058 0	39	5561 2
7	32 2	18	516 12	29	2286 7	40	6000 0
8	48 0	19	643 0	30	2530 4	41	6439 3
9	68 5	20	750 0	31	2792 4	42	6878 1
10	93 12	21	868 3	32	3072 0	43	7317 4
11	124 12	22	998 4	33	3369 1	44	7756 0

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M I N

By this construction the radii of the bases being always equal to the lines of least resistance, the solids are similar, and therefore are to each other as the cubes of their axes; i. e. as the cubes of the lines of least resistance: so that, taking any one of the charges to be true, the others will be found, by saying, *As the cube of the axis, whose charge is given, is to its charge, so is the cube of the axis of any other mine to its charge.*

For example, let the charge 93½ of the mine, whose line of least resistance is 10 feet, be given, and it be required to find the charge of any other mine, whose line of least resistance is given, suppose 15; then say, as the cube 1000 of 10, is to the cube 3375 of 15, so is the charge 93½ to the charge required, which is 316.4, or 316lb. 6 ounces, which is 2 ounces more than in the table. In the same manner is found the charge of a mine whose line of least resistance is 20; or because 20 is double of 10, the cube of 20 will be double the cube of 10; and therefore $8 \times 93\frac{1}{2}$, or 750lb. will be the charge for that mine.

Table for the charge of MINES, according to Mr. Muller.

Diam.	Charge	Diam.	Charge	Diam.	Charge
feet	lb.	feet	lb.	feet	lb.
22	150	42	639	62	1518
24	181	44	711	64	1621
26	217	46	773	66	1741
28	255	48	857	68	1842
30	297	50	946	70	1980
32	344	52	1000	72	2098
34	394	54	1115	74	2243
36	452	56	1205	76	2372
38	502	58	1299	78	2501
40	560	60	1406	80	2648

In this table the line of least resistance is supposed to be always 10 feet, and the charges producing the openings at the sides of them from 22 feet to 80. Hence, we suppose that

the charge of 93½ feet of a mine, whose line of least resistance and radius of the base are each 10 feet, are given; and from thence the rest are computed by means of these equations

$KC = \sqrt{AC^2 + FC^2}$ and $p \times KC = a$ (fig. 6.): and, as we have observed, by comparing the diameters of the bases, found, by means of these equations, to be rather less than those found by experiments, it is presumed that the diameters, marked in this table, will not be found less, but rather greater, in practice.

TABLE of CUBE BOXES for the charges of MINES, from 50 to 640 pounds.

Cha.	Side	Cha.	Side	Cha.	Side	Cha.	Side
50	12.5	155	18.3	255	21.5	450	26.1
55	12.9	160	18.5	260	21.7	460	26.2
60	13.3	165	18.6	270	22.0	470	26.4
65	13.6	170	18.8	280	22.2	480	26.6
70	14.0	175	19.0	290	22.5	490	26.8
75	14.3	180	19.2	300	22.8	500	27.0
80	14.6	185	19.4	310	23.0	510	27.2
85	14.9	190	19.6	320	23.3	520	27.3
90	15.2	195	19.7	330	23.5	530	27.5
95	15.5	200	19.9	340	23.7	540	27.7
100	15.8	205	20.0	350	24.0	550	27.9
105	16.0	210	20.2	360	24.2	560	28.0
110	16.3	215	20.4	370	24.4	570	28.2
120	16.8	220	20.5	380	24.6	580	28.4
125	17.0	225	20.7	390	24.8	590	28.5
130	17.2	230	20.8	400	25.0	600	28.7
135	17.4	235	21.0	410	25.3	610	28.8
140	17.6	240	21.1	420	25.5	620	29.0
145	17.8	245	21.3	430	25.7	630	29.1
150	18.0	250	21.4	440	25.9	640	29.3

A cubic foot of common powder weighs about 55lb. If we say, As 55 is to unity, so is any other quantity to its cube; that is, if the given quantity of powder be divided by 55; the quotient will be the cube required, and its cube root will be the length of the side of the cube box.

Example, to find a cube which shall hold 360lb. Divide 360 by 55; you will have 6.545 for the cube expressed in feet; and the cube root 1.875 feet, or 22.5 inches of that number, will be the length of the side of that cube.

The box must always be made $\frac{1}{4}$ bigger than it should be, on account of the straw and sand-bags put in it, to keep the powder from receiving any damage from wet; so that, if the quantity of powder be 360lb. the $\frac{1}{4}$ part of it, which is 90, must be added, and the sum 450 divided by 55, to have 8.1818, whose square root, 2.86 feet, or 35 inches, will be the side required.

Globe of compression in MINES, from Belidor. If you imagine a large globe of earth homogeneous in all its parts, and a certain quantity of powder lodged in its centre, so as to produce a proper effect without bursting the globe; by setting fire to the powder, it is evident, that the explosion will act all round, to overcome the obstacles which oppose its motion; and as the particles of the earth are porous, they will compress each other in proportion as the flame increases, and the capacity of the chamber increases likewise: but the particles of earth next to the chamber will communicate a part of their motion to those next to them, and those to their neighbours; and this communication will thus continue in a decreasing proportion, 'till the whole force of explosion is entirely spent; and the particles of earth beyond this term, will remain in the same state as they were at first. The particles of earth that have been acted upon by the force of explosion will compose a globe, which Mr. Belidor calls the *globe of compression*.

From several experiments with various charges, made by Mr. Belidor at la Fere, and by M. Dalencourt in Portugal, (at the latter of which I was present) it appeared, that the greatest diameter of an excavation may not only be made double, but triple or quadruple; contrary to the general opinion. From these experiments we are convinced, that the diameter of the excavation could be made greater than was imagined; but for what reason, was not hitherto known, 'till M. Belidor demonstrated it, in the Memoirs of the Academy of Sciences at Paris, in the year 1762.

To explain the reasons on which the principles of mines are grounded, it is necessary to consider, not only the resistance which the weight of the earth and the cohesion of the parts make against the force of explosion, but likewise the pressure of the atmosphere, which is so great as to counterbalance a column of water of the same base, whose altitude is 33 feet, which answers nearly to a height of a middling soil of about 22 feet: so that, if the line of least resistance of a mine be 10 feet, the force of explosion must not only overcome the weight of 10 feet of earth above it, but 32 feet, properly speaking. It is, however, to be observed, that this weight resists the force of explosion no longer than 'till the mine bursts, and the explosion gets a communication with the air; because then the pressure of the air ceases.

Pl. VII. fig. 5. As the powder does not fire all at once, but gradually, so the force of explosion increases proportionally, and condenses the earth all round in a spheric form, 'till this force overcomes the resistance of the earth and atmosphere, which cannot happen before the earth rises in the middle in a spheric form, and the radius CA of explosion extends to the surface AB of the earth; and then the explosion, getting a free communication with the air, raises the earth to a considerable height, and forms an excavation of a curve-lined figure, such as AEB . The point C represents the centre of the powder or chamber.

It is a known principle, established by facts, that the force of explosion is always proportional to the quantity of powder fired; and as the force of explosion acts in a spheric form, and spheres are as the cubes of their radii, it is evident, that the forces of explosion, or the quantities of powder fired, are proportional to the cubes of their radii.

This proportion will always hold good in an uniform soil, but varies according to the density: and if the chamber of a mine be placed in a rock, or some other hard substance, the diameter of the excavation will be greater than it would have been otherwise; because the force of explosion, being resisted downwards, will act with more violence towards the sides, and upwards. A mine, placed in a soil of a greater density and tenacity than another of the same depth, requires a greater charge in proportion; but it must be observed, that the tenacity is not proportional to the surface of the excavation, as M. de Valliere and some others pretend, but to the solid itself, as explained in M. Muller's treatise on mines.

To find a proper charge for a mine in any soil, so as to produce a given diameter, an experiment mine must be made in the same soil, sufficiently charged, so as to produce a proper effect, and the line of least resistance exactly measured, as well as the diameter of the opening, by which the radius CA of the globe of compression will be found: then say, *The cube of the radius of the globe of compression found by the experiment, is to the cube of the radius of the proposed mine, as the charge of the experiment mine is to the charge required.*

And to find the diameter of the mine whose charge is given, say, *The charge of the experiment mine, is to the given charge, as the cube of the radius of the first, is to the cube of the radius of the second.* From whence the diameter required is found by this equation, $CA^3 - CD^3 = AD^3$.

We have hitherto computed the diameters of mines from their charges; we shall now give some examples how to find the charges from the given diameters. Thus, a mine, made in the same soil above mentioned, whose line of least resistance is 10 feet, it is required to find the charge: so as to make a diameter of 40 feet: the sum of the squares of the line of least resistance 10, and $\frac{1}{4}$ the diameter 20, gives 500 for the square of the radius of the globe of compression; and the square root 22.36 of 500, multiplied by 500, gives 11180, for the globe of compression: then the globe of compression 4412 of the second mine, is to the globe of compression 11180, as the charge 160 of the experiment mine, is to the charge required, which will be 405lb. nearly. Again, let a mine, whose line of least resistance is 10 feet, be loaded with 170lb. of powder, having a diameter of 20 feet: it is proposed to make another in the same soil, whose line of least resistance is 15 feet, and diameter 70. To find its charge, say, the square 12.5 of $\frac{1}{4}$ the diameter 70, added to the square 225 of the line of least resistance 10, gives 1450, whose root is 38 nearly; and 1450, multiplied by 38, gives 55100 for the globe of compression; and as the globe of compression of the experiment mine, has been found above to be 2828, we have $2828 : 55100 :: 170 : 3312$ lb. of powder for the charge required.

We will now show the application of the globe of compression in the defence of places, and profiles of countermines made at la Fere, and also at the famous siege of Schweidnitz in 1762. Pl. VII. fig. 7, 8, 9. The first chamber C blew up two 24-pounders towards the trenches: the battery being re-established, the chamber D threw the guns into the ditch:

the batteries being re-established again, the chamber E threw the artillery again into the ditch, to the great surprise of the spectators, some of whom expected quite the contrary.

In 1764, a battery was raised in all its forms at Potsdam, by major Le Fevre, engineer in the Prussian service, for two 24-pounders: under the middle of which a gallery, fig. 10. 11. was made from the foot T of the banquet, of 20 feet long; from which two branches, GH ; GI , were made, each of 8 feet long, to place the chambers A, A , whose line of least resistance was 7 feet only, and exactly under the axle-trees of the guns: the gallery was continued in a slope, to form 2 other branches, KL , NK , in the same manner as the preceding ones, but lower, to place the chambers B, B , whose line of least resistance was 10 feet, and at the same distance from the former A , taken horizontally, in order to have the right-angled isosceles triangle BDC , fig. 10, whose hypotenuse, BC , shows the direction of the action of the powder.

The intent of little chambers, AA , being to overcome the tenacity of the soil, without any other effect, were charged each with 20lb. of powder only; whereas the others, BB , were each loaded with 600lb. The length of the leaders was so contrived, as to set fire to F , then to G , and from thence to the chambers AA , and to the point K , at the same time; also to the chambers BB , in a few seconds afterwards. The first, AA , having produced a proper effect, the second, BB , met with less resistance towards the wheels of the carriages than towards the trail, raised the pieces about 240 feet, and then threw them 210 feet from the battery into the ditch.

Though the centres of the two chambers were 18 feet from each other, yet they produced but one excavation, of an elliptic form, whose greatest diameter was 45 feet, and the least 27, the depth 18, the bottom well cleared, without hurting the parapet of the covert-way. If then two mines produced so great an excavation, to what extremity will the besiegers be reduced, if a battery of 10 or 12 pieces of artillery was blown up? for where will they find earth to fill up an excavation of 210 or 240 feet in length, and from 15 to 18 feet deep? What time will be lost in repairing all these damages! and what destruction must there be amongst the soldiers, from the fire of shells, carcasses, and grenades, continually thrown into such a confined place!

In 1753, the French king gave orders for some experiments to be made at Bisy, to render useless

less the countermines of a besieged town, by bursting the galleries all round, above and below, to a certain distance; or to change these galleries into so many trenches, by which the covert-way may be taken at once, with very little trouble. The work begun with what belongs to the globe of compression. A soil had been fixed upon, the most uniform that could be found, which happened to be a hard sand, mixed with gravel. Four galleries were made, *A, B, C, D* (Pl. XIII. *fig. 7.*) 3 feet wide, and 6 feet high, so as to form a rectangle, whose sides answered nearly to the four cardinal points: the two opposite ones, *A, B*, which faced the north and south, were each 60 feet long, and the other two, *C, D*, which faced the east and west, 72 feet: they were lined with stones, in order to show that masonry was rather an advantage, than an obstacle to the effects of powder. The bottom of these galleries had a slope of 6 feet 3 inches, and the mean depth was 15 feet under the surface of the ground, which terminated in a descent from south to north, between the interval of the galleries of that name. In that to the east *C*, a branch, *LK*, was made at right angles, of 24 feet long, and at *K* another, *KE*, at right angles to this, to place a chamber, *E*, 30 feet from the gallery *A*, 36 from *D*, and 42 from *B*. The other galleries were made by means of 2 shafts, or pits, *M, I*: the one, *M*, to the south, was 16 feet deep, and the other, *I*, to the north, 20.

When these galleries were finished, the last shaft *I*, was deepened 9 feet more; so that the bottom *I*, (*fig. 8.*) was 29 feet below the surface of the ground, near the chamber. After this a gallery *YX*, was made, going directly under the chamber *E*, with a descent of 18 inches, and 5 feet high; by which its top was 14 feet below the centre of the chamber *E*: the whole supported with strong oak planks, and still in the same sort of soil as mentioned before, but so hard, that the miners were obliged to use their chissels. Such was the disposition belonging to the globe of compression; whose object was, to see whether it would burst all these galleries. The globe of compression, which had been charged only 24 hours with 3000 lb. of powder, was set fire to on the 13th of June, 1753, in the presence of several officers, and other persons of quality; when it raised the earth about 150 feet high. They then went to see whether it had destroyed the galleries about it, and to what distance the globe of compression had acted. It was found that it formed an excavation perfectly round, of 66 feet diameter, and 17 deep.

The east gallery *C*, lined with masonry, at 24 feet distance from the chamber, was entirely burst from one end to the other.

The south gallery *A*, at 30 feet distance from the chamber, was equally burst from end to end, excepting 12 feet near the entrance *M*, at the west.

The west gallery *D*, of 72 feet long, and 36 distant from the chamber, was destroyed to the length of 42 feet: 18 feet were left near its entrance at the north, and 12 feet at the other end.

The north gallery *B*, which was 60 feet long, and 42 from the chamber, was destroyed all but 12 feet at its entrance, at the west: so there was 48 feet impracticable, which were divided into 2 equal parts by the perpendicular drawn from the centre of the chamber of that gallery. As that line formed a right-angled triangle, with $\frac{1}{2}$ the gallery destroyed, whose hypotenuse is 48 feet, which hypotenuse is the radius of the globe of compression; this shows that it would have destroyed a gallery at that distance, and consequently quadruple the line of least resistance.

The gallery *Y, X, S*, (*fig. 8.*) which passed under the chamber *E*, whose top was 14 feet from it, and length 69, could not be entered farther than the length *YZ*, of 24 feet, so that 45 feet of it was destroyed: as the extremity of this gallery was 9 feet beyond the centre of the chamber, it appears, that there remain 60 feet from the middle to the entrance; and as there were 24 feet not destroyed, there remained 36 destroyed on that side, which being taken for the base of a right-angled triangle, *ZSE*, and the perpendicular, *ES*, being 14 feet, the hypotenuse, *EZ*, is found to be 38 feet, which is the radius of the globe of compression: so that it would have destroyed a gallery whose top had been at that distance under the mine, consequently 50 feet under the surface of the ground, which is the greatest distance that a gallery can ever be made. From hence it follows, that if the line of least resistance had been 15 or 16 feet, instead of 12, the globe of compression would have destroyed a gallery of 60 feet distant from the chamber; consequently, if the chamber was placed at that depth, and nearly in the middle between 2 listening galleries, whose distance is generally from 90 to 144 feet, it would have burst both the envelope, and all those under and above them, by increasing the quantity of powder in proportion. This proves the great use that may be made of the globe of compression in the attack of a place countermined.

Pl. XIII. *fig. 17.* To apply this method of attacking the countermines in a place besieged, we supposed the first and second parallels made the latter *A, B, C,* distant about 360 feet from the palisades of the covert-way; and from thence the trenches are carried on in the capital of the ravelin, and in those of the adjacent bastions of the front attacked; and after this, batteries, *L,* are made of cannons and mortars, to enfilade by ricochet the covert-way and the ramparts parallel to it, to destroy their defences. During this time, the sappers carry on the saps towards the places of arms in the covert-way, both salient and re-entering; to establish the heads *E T,* near the ends of the listeners, *G, G,* before the salient angles; and the miners proceed under ground to place chambers *I,* overcharged, between the extremities of the listeners of the re-entering angles. We suppose they have taken the precaution to sink their shafts as deep as the countermines; that the chambers may nearly be upon a level with the galleries; and that the shafts are placed in the trenches, *K,* which lead from one battery to the other, not to interfere with any other works. From the bottom of these shafts they make the galleries, *KL,* of about 120 feet long. This will be a work of about 4 or 5 days to the establishing their chambers, which should be finished at the same time, that they may be sprung together: by this time the sappers will be got to the heads *E F,* to induce the besieged to spring some of their mines, to destroy them.

Supposing that they have sprung 2 or 3 mines at each side, as soon as this is done, the miners enter into the excavations to discover the galleries; which they must do at the same time, while the sappers form a lodgment in the excavation. When the galleries are found and cleared, they stop up their entrances, to keep in the smoke, 'till they want to make use of them. On the other hand, all the globes of compression are fired, and from their excavations search is made on the right and left to discover the *listeners*; so that, if the measures have been rightly taken, 14 entrances into the countermines will be found, by which it will be out of the power of the besieged to resist equally every where: should there be but half that number practicable, it would be sufficient to get possession of all their mines; of which only those that are convenient to advance the siege, are to be changed into trenches.

Fig. 18, and 19, show the disposition of the chambers of countermines, in a profile parallel to the covert-way, and in a profile perpendicular to the same.

At the siege of Schweidnitz, in 1762, three globes of compression were sprung; every one of which answered beyond expectation.

MINERS, in a *military sense*, are generally soldiers: most of the foreign regiments of artillery have each a company of miners, commanded by a captain and 2 lieutenants. When the miners are at work in the mines, they wear a kind of hood, to keep the earth that falls, out of their eyes. In the English service, artillery soldiers are commanded for that purpose.

MINERS tools, consist in several sorts of spades, wheel-barrows, axes, hand-levers, chisels, sounding-augres, sledge-hammers, masons hammers, mattocks, augets, plummets, miners rule, and miners dial, &c.

Different sorts of MINES, are as follow:

Fougasses, are a sort of small mines, frequently made before the weakest parts of a fortification, as the salient angles and faces, not defended by a cross fire.

Trefle-MINES, are mines with two chambers only.

T-MINES, so called from the great resemblance of that letter. They are double mines, having four lodgments.

Double T-MINE, has eight lodgments, and four doors.

Triple T-MINE, has twelve lodgments, and six doors.

Double Trefle-MINE, has four lodgments, and eight doors.

Triple Trefle-MINE, has six lodgments, and twelve doors.

MINION, a piece of ordnance, formerly so called, of which were two sorts, the large and small; answering to our present 6-pounders. See **CANNON**.

MINUTE, in *military affairs*, the 60th part of a degree; and, in *computation of time*, the 60th part of an hour: it also denotes a short memoir or hasty sketch taken of any thing in writing.

MOAT, in *fortification*. See **DITCH**.

MOINEAU, a French term for a little flat bastion, raised upon a re-entering angle, before a curtain which is too long, between two other bastions. It is commonly joined to the curtain, but sometimes separated by a fosse, and then called a detached bastion. They are not raised so high as the works of the place.

MOUNT-PAG-NOTE, or *post of the invulnerable*, an eminence chosen out of cannon-shot of the place besieged.

MORASS, in *military drawings*, denotes moor,

moor, marshy, or fenny low grounds, on which waters are lodged.

MORTARS, are a kind of short cannon, of a large bore, with chambers: they are made of brass or iron. Their use is to throw hollow shells, filled with powder; which, falling on any building, or into the works of a fortification, burst, and their fragments destroy every thing within reach. Carcasses are also thrown out of them, which are a sort of shells, with 5 holes, filled with pitch and other combustibles, in order to set buildings on fire; and sometimes baskets full of stones, the size of a man's fist, are thrown out of them upon an enemy, placed in the covert-way in the time of a siege. Of late, the very ingenious general Desaguliers has contrived to throw bags, filled with grape-shot, containing, in each bag, from 400 to 600 shot of different dimensions, out of mortars; the effect of which is so very awful and tremendous to troops forming the line of battle, passing a defile, or landing, &c. pouring down shot, not unlike a shower of hail, on a circumference of above 300 feet. They are distinguished chiefly by the diameter of the bore. For example, a 13-inch mortar is that, the diameter of whose bore is 13 inches. There are some of 10 and 8-inch diameters; and some of a smaller sort, as cohorns of 4.6 inches, and royals of 5.8 inches. See Pl. XIII. fig. 5.

All English mortars are fixed to an angle of 45 degrees, and custom has prevailed to lash them strongly with ropes to that elevation. In a siege, shells should never be thrown with an angle of 45 degrees, excepting one case only; that is, when the battery is so far off that they cannot otherwise reach the works: for when shells are thrown out of the trenches into the works of a fortification, or from the town into the trenches, they should have as little elevation as possible, in order to roll along, and not bury themselves; whereby the damage they do, and the terror they cause to the troops, is much greater than if they sink into the ground. On the contrary, when shells are thrown upon magazines, or any other buildings, with an intention to destroy them, the mortars should be elevated as high as possible, that the shells may acquire a greater force in their fall, and consequently do more execution. We are the only nation that fix mortars to an elevation of 45 degrees.

The use of mortars is thought to be older than that of cannon; for they were employed in the wars of Italy to throw balls of red-hot iron, and stones, long before the invention of shells. It is generally believed the Germans

were the first inventors, and that they were actually used at the siege of Naples, under the reign of Charles VIII. in 1435. History informs us, with more certainty, that shells were thrown out of mortars at the siege of War-tendonk, in Gelderland, in 1588, by the earl of Mansfield. Shells were first invented by an unfortunate accident, by a citizen of Venlo, who, on a festival, celebrated in honour of the duke of Cleve, threw a certain number, one of which fell on a house, and set fire to it; by which misfortune the greatest part of the city was reduced to ashes. Mr. Malter, an English engineer, first taught the French the art of throwing shells, which they first practised at the siege of Motte, in 1634. The method of throwing red-hot balls out of mortars, was first put in practice, with certainty, at the siege of Straalsund, in 1675, by the elector of Brandenburg; though some say in 1653, at the siege of Bremen.

Land-MORTARS, are those used in sieges, and of late in battles, mounted on beds; and both mortar and bed are transported on block-carriages. There is likewise a kind of land-mortars, mounted on travelling-carriages, invented by count Buckeburg, which may be elevated to any degree; whereas ours are fixed to an angle of 45 degrees, and firmly lashed with ropes.

Partridge-MORTAR, is a common mortar, surrounded by 13 other little mortars, bored round its circumference in the body of its metal. The centre one is loaded with a shell, and the others with grenades. The vent of the large mortar being fired, communicates its fire to the small ones; so that both shell and grenades go off at once. The French used them in the war of 1701, and more especially at the siege of Lisle, in 1708, and at the defence of Bouchain, in 1702.

Hand-MORTARS, frequently used before the invention of cohorns. They were fixed at the end of a staff of 4½ feet long, the other end being shod with iron to stick in the ground: while the bombardier, with one hand, elevates it at pleasure, he with the other hand fires.

Firelock-MORTARS, } are small mortars, fixed
Bombards, } at the end of a firelock: they are loaded as all common firelocks are; and the grenade, placed in the mortar at the end of the barrel, is discharged by a flint-lock; and, to prevent the recoil hurting the bombardier, the bombard rests on a kind of halberd, made for that purpose. They were first invented by major-general Siebach, a German, about the year 1740.

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Names of the several parts of a MORTAR.			
A. B.	The	whole length of the mortar	Grand divisions exterior.
A. C.		muzzle	
C. D.		chace	
D. E.		reinforce	
E. F.		breech	
G. H.		trunnions	
a.		vent	
b.		dolphins	
c. d.		vent astragal and fillets	
d. e.		breech ring and ogee	
f. g.	reinforce ring and ogee	Small divisions exterior.	
g. b.	reinforce astragal and fillets		
i. k.	muzzle astragal and fillets		
k. l.	muzzle ring and ogee		
l. m.	muzzle mouldings		
n.	shoulders		

o.	The	chamber	Interior parts.
p.		bore	
q.		mouth	
r.		vent	

Chamber in MORTARS, is the place where the powder is lodged: they are of different sorts, and made variously by different nations. The Spaniards use chiefly the spheric; the French, Germans, and Dutch, the conic, cylindric, and the concave or bottled; the Portuguese, at present, the parabolic; and the English make them in the form of a frustum of a cone. Each nation has its reasons, good or bad, to prefer their make before that of others: among which, we are of opinion that the concave and cylindric chambers are the best.

Dimensions of brass land MORTARS, now in use.

Diameter of the bore	13 inch.	10 inch.	8 inch.	5.8 royal	4.5 cohorn
Total length of the mortar	44.	33.	25.5	16.5	13.5
From the mouth to the reinforce	15.25	10.	8.5	4.75	4.2
reinforce	8.75	8.1	5.	5.	3.9
trunnions	7.15	6.3	5.	2.75	2.15
Length of the trunnions from end to end	35.5	26.	20.	12.	9.2
bore	24.	18.	13.	8.5	7.
chamber	6.6	4.5	4.	3.	2.7
Greatest diameter of the chamber	6.6	4.5	4.	3.	2.7
Least	6.	3.6	3.4	2.4	1.4
Diameter of the muzzle ring	21.	15.15	11.2	8.	6.4
Breadth of the muzzle ring	1.1	.8	.6	.7	.5
astragals and fillets	1.25	1.	.75		
Distant from the muzzle ring	1.5	1.	1.		
Diameter near the muzzle astragal	18.1	13.2	10.	6.9	5.6
reinforce	18.1	13.2	10.	6.9	5.6
Diameter of the reinforce	21.	15.15	15.1	8.	6.4
Breadth of the ogees	1.5	1.	1.		
Diameter behind the breach astragal	18.1	13.2	9.8	6.9	5.9

The dimensions in the above table are expressed in inches.

Weight

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Weight of Land-MORTARS and shells; together with the quantity of powder the chambers hold when full; the weight of the shells, and powder for loading them.

Nature of mortars	-	13-inch mortar.	10-inch mortar.	8-inch mortar.	5.8-inch royal.	4.5-inch coehorn.
Mortar's weight	C.	25 0 0	10 2 18	4 0 20	1 0 0	0 3 0
Shell's weight	C.	1 2 25	0 3 2	0 1 17	0 0 13	0 0 7
Shell cont. powder	lb.	9 4 8	4 14 12	3 8	1 1 8	0 8 0
Chamb. cont. powd.	lb.	9 1 8	4 0 0	2 0 10	1 0 10	0 8 0

The dimensions in this table are expressed, where the C. stands, in hundreds, quarters, and pounds; and where lb. stands, in pounds ounces, and grains.

Land MORTAR-BEDS, are made of solid tim-

ber, consisting generally of 4 pieces, those of the royal and coehorn excepted, which are but one single block. Their uses are to mount the land-mortars on them, for actual service; and they are well secured with iron-work, &c.

Dimensions of present Land MORTAR-BEDS, in inches. See Pl. IV. fig. 1. and 2.

Nature of beds	-	13	10	8	5.8	4.6
Lower bed	length	84.	66.	50.	0.	0.
	breadth	33.	20.	0.	0.	0.
	height	13.	10.	9.	0.	0.
Upper bed	length	83.	65.	49.	31.5	28.5
	breadth	32.	25.	19.	16.	14.
	height	13.	12.	11.	10.	9.
Breadth quarter round	-	3.	2.5	2.5	0.	0.
Of the ogee and fillet	-	4.	3.5	3.	0.	0.
Length of the cavity	-	20.	16.	12.	8.	5.7
Trun. holes from fore end	-	31.	20.	15.5	13.3	11.7
Diameter	} of trun. holes {	7.2	6.4	5.4	3.4	2.4
Depth		7.	6.	5.	3.2	2.2

Names and number of iron-work, in a 13, 10, and 8-inch MORTAR-BED.

a. Cap-squares	-	2
b. Eye-bolts	-	2
c. Joint-bolts	-	2
d. Under and upper bed-bolts	-	9
e. Dowel-bars	-	4
g. Rings with bolts	-	4

b. Reverse bars	-	2
k. End riveting-plates	-	2
l. Middle plate	-	1
m. Riveting	} bolts {	6
n. Square riveting		12
p. Traversing		6
q. Keys, chains, and staples	-	2

Names

Names and number of iron-work in a royal and coehorn MORTAR-BED.

a. Cap-squares	-	-	2
b. Eye-bolts	-	-	2
c. Joint-bolts	-	-	2
d. Riveting-bolt, with ring	-	-	1
f. Handles, with starts	-	-	2
g. Square riveting-plates	-	-	5
h. Keys, chains, and staples	-	-	2

Sea-MORTARS, are those which are fixed in the bomb-vessels, for bombarding of places by sea: they are made somewhat longer, and much heavier, than the land-mortars.

Dimensions of Sea-MORTARS, 13 and 10 inches.

Diameter of the bore divided into	30	30
Length of the bore	75	75
Diameter } of the chamber {	15	15
Length } of the chamber {	33	33
From the end of the chamber to the end of the mortar	20	20
Total length of the mortar	128	128
From the muzzle <i>a</i> to the reinforce <i>b</i>	43	43
Length of the reinforce <i>b c</i>	28	28
Thickness of the metal at the muzzle, mouldings excepted	8	7
Thickness of metal { near the reinforce	9	8
Thickness of metal { at the reinforce	10	9
Thickness of metal { at the chamber	16	16
Breadth of the { muzzle-ring and fillets	4	4
Breadth of the { ogee next to it, and of that before the reinforce	3	3
Distance from the ogee to the muzzle-astragal	6	6
Breadth of the { astragal and fillets	3	3
Breadth of the { ogee behind the reinf.	4	4
The muzzle-ring projects the metal by	1.5	1.5
Diameter of the trunnions	18	18
Length of the trunnions from the mortar	20	20
	<i>d</i>	<i>d</i>

The content of the chamber	-	126	126
Weight of the metal	-	2. 1d	1.8d

Weight of Sea-MORTARS and shells; with the quantity of powder to fill the shells and chambers.

Diameter of the bore	13-inch mortar	10-inch mortar
Weight of present sea-mortars - - - C.	81 1 18	32 3 7
Weight of shells - C.	1 2 25	0 3 2
Chamb. contains pow. lb.	32 0 0	12 8 c
Shell contains powder lb.	9 4 8	4 14 12

It has been very justly observed, that the breech of our 13-inch sea-mortars is loaded with an unnecessary weight of metal. The chamber thereof contains 32 pounds of powder; and at the same time they are never charged with more than 12 or 15 pounds, because the bomb-ketch is unable to bear the violent shock of their full charge. Thus the action of the powder is diminished by the vacancy left in the chamber.

Land-MORTAR-BEDS, are made of very solid timber, and placed upon very strong timber frames, fixed in the bomb-ketch; to which a pintle is fixed, so as the bed may turn round. The fore part of these beds is an arc of a circle, described from the same centre as the pintle-hole. The plans, elevations, and sections, show, in a distinct manner, the several parts of the beds. See PL. V.

Dimensions of Sea-MORTAR-BEDS, of 13 and 10 inches.

Length	-	94	84
Breadth } of the bed {	-	54	47
Height } of the bed {	-	27	23
Pintle-hole from the fore-end	-	39	32
Diameter of the pintle-hole	-	6.5	.5
Trunnions from the fore-end	-	45	42.5
Diameter } of trunnion-holes {	-	10	8
Depth } of trunnion-holes {	-	8	5
Diameter } of the circular bed {	-	59	59
Height } of the circular bed {	-	8	6
Distance to the bed-bolster	-	15	16
Depth of the cavity	-	15	12
Its opening above	-	30	21
Bed-bolster length	-	53	44
Length below	-	29	2.1
Its height	-	16	17
Its breadth	-	14	12

Iron-work of Sea-MORTAR-BEDS.

a. Cap-squares	-	-	2
b. Eye	-	-	6
c. Loop	-	-	4
d. Traversing	-	-	4
e. Middle plate	-	-	1
f. Riveting-plates	-	-	1
g. Riveting-bolts	-	-	6
h. Cross-bed bolts	-	-	7
i. Square riveting-plates for ditto	-	-	7
k. Down-bed bolts	-	-	15
m. Bed-bolster plates	-	-	2
Keys, chains, and staples	-	-	6
Nails to the bed-bolster bed	-	-	4
Bed-bolster rings and loops	-	-	2

Stone-MORTARS, serve to throw stones into the

the enemy's works, when near at hand; such as from the town into the trenches in the covert-way, or upon the glacis; and from these trenches into the town. The bore is terminated by two quadrants of a circle, terminated by the reinforce and lines drawn from the ends of the cylinder, made to lodge the tompons parallel to the axis of the mortar. The bottom of the conic chamber is terminated by an arc of 60 degrees, and the round part of the outside is a semi-circle.

Dimensions of Stone-MORTARS.

<i>Dimensions of Stone-MORTARS.</i>			Parts
Diameter of the bore divided into	-	-	30
Length of the {bore	-	-	37
{chamber	-	-	16
Its {greatest} diameter {	-	-	8
{least} {	-	-	6
Diameter of the cylindric part to hold } a wooden tompon	-	-	14
Depth or axis of that cylinder	-	-	3
From the muzzle to the reinforce	-	-	20.5
Length of the reinforce	-	-	8
Thickness of metal at the {	muzzle	-	3.5
	reinforce	-	4.5
	chamber-belt	-	9
	entrance of the } chamber	-	6
The chamber enters into the trunnions by	-	-	2
Diameter of the trunnions	-	-	40
Length from end to end of the trunnions	-	-	40
Breadth of the {	muzzle-ring and fillets	-	3
	chamber-belt	-	2
	ogee next to the belt	-	3
			<i>d</i>
Content of the chamber	-	-	<hr/>
			1102
			<i>d</i>
Weight of metal in this mortar	-	-	<hr/>

The weight of a 13-inch stone mortar is 10 3 4, and the chamber contains 3 pounds of powder.

Chambers in MORTARS, are of different sorts and dimensions. Mr. Belidor mentions four; namely, the cylindric, the spheric, the conic, and the concave or bottled; to which a fifth may be added, the parabolic, invented by count de Lippe Buckeburg.

Cylindric chambers. This kind of chamber is, in our opinion, for all kind of mortars under a 13-inch diameter, the best. They are the only kind of chambers that may be conveniently loaded with cartridges. Though experience demonstrates that concave chambers will throw the shell farthest of any with the same charge; yet, in this case, where but little powder is re-

quired, their entrance would become too narrow, and consequently inconvenient to clean; whereas, when they are cylindric, the difference between the advantages of the one and the other will be but little, and not attended with any inconveniences.

Conic chambers, are generally made in a circular form at the bottom, so that the sides produced, meet the extremities of the diameter at the mouth; it being imagined, I suppose, that the powder acts in right lines parallel to the sides of the chamber; but, as that is not the case, we conclude, contrary to Belidor and others, that the conic chambers are the worst of all.

Spheric chambers, are much inferior to the cylindric or concave; for it is well known by the properties of geometry, that when a cylinder and a frustum of a cone occupy equal spaces, the surface of the cone is always greater than that of the cylinder. Hence, if the entrance of these chambers be not made very narrow, contrary to practice, as demonstrated by Mr. Muller, in his second edition of Artillery, page 38 of the introduction, and the examples that follow, we conclude that these and the conic chambers are the worst.

Concave chambers. The advantage of these kinds of chambers consists in this, that their entrance may be made narrower than those of any other form; and practice has sufficiently proved it: yet, when the entrance is so small as not to admit a man's hand, they are not easily cleaned; for which reason all 13 and 10-inch mortars should have concave chambers, and the others cylindric ones.

Parabolic chambers. These chambers, being the widest of any, may therefore be included among the worst; as it is not the inward figure of the chamber, but its entrance, which produces the effect; because the smaller it is, the nearer it reduces the effect into the direction of the shell. It has however one advantage; namely, that the shells will have no windage. See *dimensions of mortars*, at the word MORTAR. See also VENTS.

MORTAR, in *military architecture*, a composition of lime, sand, &c. mixed up with water, that serves as a cement to bind the stones, &c. of any building. Fine sand makes weak mortar, and the rounder the sand, the stronger the mortar; and if the sand is washed before it is mixed, so much the better.

The proportion of lime and sand for making of mortar is extremely variable. Some use three parts of pit-sand, and two of river-sand, to one of lime; others, a proportion of sand to quick-lime as 36 to 35. It should be

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well mixed, and beat every 24 hours for a week together, letting it then lie for a week more; and when it is used, must be beat and mixed again. By this means it will make good mortar, though the lime is but indifferent.

MORTAR for *water-courses, cisterns, &c.* is made of lime and hog's-lard; sometimes mixed with the juice of figs, and sometimes with liquid pitch, which is first flaked with wine; and, after application, it is washed over with linseed-oil.

MORTAR for *furnaces, &c.* is made with red clay wrought in water, wherein horse-dung and chimney-foot have been steeped; by which a salt is communicated to the water, that binds the clay, and makes it fit to endure the fire. The clay should not be too fat, lest it should be subject to chinks; nor too lean or sandy, lest it should not bind enough.

MORTAR, made of terras, pozolana, tile-dust, or cinders, is mixed and prepared in the same manner as common mortar; only these ingredients are mixed with lime instead of sand in a due proportion, which is to be in equal quantities. As this mortar is to be used in aquatic buildings, the lime should be the very best.

In fortifications, docks, or piers of harbours, I would lay all the works under water with terras-mortar, and the rest of the facings, both within and without, with cinder or tile-dust mortar, for about two feet deep.

MOTION, is defined to be the continued and successive change of place. There are three general laws of motion: 1. That a body always perseveres in its state of rest, or of uniform motion in a right line, till by some external force it be made to change its place: for a body is passive in receiving its motion, and the direction of its motion, so it retains them without any change, 'till it be acted on by something external. 2. The second general law of motion is, that the change of motion is proportional to the force impressed, and is produced in the right line in which that force acts. 3. The third general law of motion is, that action and reaction are equal, with opposite directions, and are to be estimated always in the same right line.

MOTION of an army, the several marches and counter-marches it makes, or the changing of its post for an advantageous encampment, either with a design to besiege a place, to engage the enemy, or shun fighting, &c. See **MARCH**.

MOTION of a shell or shot. See **PROJECTILES**.

MOULDS, for casting shot for guns, muskets, carbines, and pistols: the first are of iron, used by the founders, and the others by the artillery in the field, and in garrison.

Laboratory-Moulds, are made of wood, for filling and driving all sorts of rockets, and cartridges, &c.

MOULDINGS, of a gun or mortar, are all the eminent parts, as squares or rounds, which serve for ornaments; such as the breech-mouldings. The rings, &c. are also called mouldings.

MOUND, in *old military books*, is a term used for a bank or rampart, or other defence, particularly that of earth.

MOUNT-guard. See **GUARD**.

MOUNTING, in *military affairs*, signifies going upon duty: thus mounting a breech, is taking possession thereof; mounting guard, mounting the trenches, is going upon duty in those places; but mounting a gun, mortar, or howitzer, is placing them on their carriages or beds.

MOVEMENTS. See **MOTIONS** of an army.

MOVEABLE-Towers. See **TOWERS**.

MULTANGULAR, is said of a figure, or body, which has many angles.

MUNITION, the provisions with which a place is furnished in order for defence, or which follow a camp for its subsistence. See **AMMUNITION**.

MURAL-Crown. See **CROWN**.

MURDRESSES, in *ancient fortification*, a sort of battlement with interstices, raised on the tops of towers to fire through.

MUSKET, } the most useful and common
MUSQUET, } dious fire-arm used by an army. They carry a ball of 29 to 2 pounds. Its length is 3 feet 8 inches from the muzzle to the pan. The Spaniards were the first who armed part of their foot with muskets. At first they were made very heavy, and could not be fired without a rest: they had match-locks, and did execution at a great distance. These kinds of muskets and rests were used in England so late as the beginning of the civil wars.

MUSKETS were first used at the siege of Rhege, in the year 1521.

MUSKETEERS, soldiers armed with muskets; who, on a march, carried only their rests and ammunition, and had boys to bear their muskets after them. They were very slow in loading, not only by reason of the unwieldiness of the pieces, and because they carried the powder and ball separate, but from the time it took to prepare and adjust the match: so that their
fire

fire was not near so brisk as ours is now. Afterwards a lighter kind of match-lock musket came in use; and they carried their ammunition in bandeliers, to which were hung several little cases of wood, covered with leather, each containing a charge of powder: the balls they carried loose in a pouch, and a priming-horn hanging by their side. These arms were, about the beginning of this century, universally disused in Europe, and the troops were armed with firelocks.

MUSKET-baskets. See **BASKETS OF EARTH.**

MUSKETOON, a kind of short thick musket, whose bore is the 38th part of its length: it carries 5 ounces of iron, or $7\frac{1}{2}$ of lead, with an equal quantity of powder. This is the shortest sort of blunderbusses.

MUSTER, in a *military sense*, a review of troops under arms, to see if they be complete, and in good order; to take an account of their numbers, the condition they are in, viewing their arms and accoutrements, &c.

MUSTER-master-general, } one who
Commissary-general of the MUSTERS, } takes account of every regiment, their number, horses, arms, &c. reviews them, sees the horses be well mounted, and all the men well armed and accoutred, &c.

MUSTER-rolls, lists of soldiers in each company, troop, or regiment, by which they are paid, and the strength of the army is known.

MUTINY, in a *military sense*, to rise against authority. "Any officer or soldier who shall

presume to use traitorous or disrespectful words against the sacred person of his majesty, or any of the royal family, is guilty of mutiny.

"Any officer or soldier who shall behave himself with contempt or disrespect towards the general or other commander in chief of our forces, or shall speak words tending to their hurt or dishonour, is guilty of mutiny.

"Any officer or soldier who shall begin, excite, cause, or join, in any mutiny or sedition, in the troop, company, or regiment, to which he belongs, or in any other troop, or company, in our service, or on any party, post, detachment, or guard, on any pretence whatsoever, is guilty of mutiny.

"Any officer or soldier who, being present at any mutiny or sedition, does not use his utmost endeavours to suppress the same, or coming to the knowledge of any mutiny, or intended mutiny, does not, without delay, give information to his commanding-officer, is guilty of mutiny.

"Any officer or soldier, who shall strike his superior officer, or draw, or offer to draw, or shall lift up any weapon, or offer any violence against him, being in the execution of his office, on any pretence whatsoever, or shall disobey any lawful command of his superior officer, is guilty of mutiny.

MUZZLE, of a gun or mortar, the extremity at which the powder and ball are put in; and hence the muzzle-ring, muzzle-alstragal, muzzle-mouldings, &c. See **CANNON.**

N

NAILS of various sorts are used in artillery. See **CARRIAGE.**

Garnish NAILS, in *travelling-carriages*, have pointed heads like diamonds, with a small narrow neck: they serve to fasten the plates with roses, to cover the side-pieces from the ends of the trunnion-plates to 5 or 6 inches beyond the centre of the carriage.

Diamond-headed NAILS, small nails, whose heads are made like a flat diamond, and serve to fix the plates upon travelling-carriages.

Garnish NAILS, small nails to fasten the plates, both upon the trail and head of travelling-carriages.

Rose-bud NAILS, are small round-headed nails, drove in the centre of the roses of the plates.

Counter-sunk NAILS, those that have flat

round heads, sunk into the iron plates, so as to be even with the outside of it.

Streak-NAILS, are those which fasten the streaks to the fellys of the wheels.

Box-pin NAILS, small nails without heads, to pin the nave-boxes to the naves.

Stub-NAILS, are driven on the outside of the nave-hoops, to keep them in their places.

Flat-headed NAILS, to fasten the locker or any sort of hinges.

Dog-NAILS, have flat round heads; and one part of the shank next to the head is also round.

NAILING of cannon. When circumstances make it necessary to abandon cannon, or when the enemy's artillery are seized, and it is not however possible to take them away; it is proper to nail them up, in order to render them useless;

useless; which is done by driving a large nail or iron spike into the vent of a piece of artillery, to render it unserviceable. There are various contrivances to force the nail out, as also fundry machines invented for that purpose, but have never been found of general use; so that the best method is to drill a new vent.

One Gasper Vimercalus was the first who invented the nailing of cannon. He was a native of Bremen, and made use of his invention first in nailing up the artillery of Sigismund Malatesta.

NATIONAL troops, are those born in our own dominions, in opposition to foreigners.

NAVAL armament, the fitting out a fleet, with all kinds of provisions and military stores, for actual service.

NAVAL camp, in *military antiquities*, a fortification, consisting of a ditch and parapet on the land side, or a wall built in the form of a semi-circle, and extended from one point of the sea to the other. This was sometimes defended with towers, and beautified with gates, through which they issued forth to attack their enemies. Towards the sea, or within it, they fixed great pales of wood, like those in their artificial harbours: before these the vessels of burthen were placed in such order, as that they might serve instead of a wall, and give protection to those without; in which manner Nicias is reported by Thucydides to have encamped himself. When their fortifications were thought strong enough to defend them from the assaults of enemies, it was frequent to drag their ships on shore, which the Greeks called *εναλκναι*, and the Romans *subducere*. Around the ships the soldiers disposed their tents, as appears every where in Homer; but this seems only to have been practised in winter, when their enemy's fleet was laid up, and could not assault them; or in long sieges, and when they lay in no danger from their enemies by sea, as in the Trojan war, where the defenders of Troy never once attempted to encounter the Grecians in a sea-fight.

NAVAL crown, in *Roman antiquity*, a crown conferred, among the Romans, on persons who, in sea-engagements, distinguished themselves. A. Gellius says, in general, the naval crown was adorned with prows of ships. Lipsius distinguishes two kinds; the first he supposes plain, and given to the common soldiers; the other rostrated, and only given to generals, or admirals, who had gained some important victory at sea.

NAVAL officers, are admirals, captains, lieutenants, masters, boatswains, midshipmen, gunners, &c.

NAVAL engagement, implies, in general, either a sea-fight between single ships, or whole fleets of men of war, or galleys, &c.

NAVE, in *gun-carriages*, that part of a wheel in which the arms of the axle-tree move, and in which the spokes are driven and supported. See **WHEEL**.

NAVE-boops, are flat iron rings to bind the nave: there are generally three on each nave.

NAVE-boxes, were formerly made of brass; but experience has shown that those of cast-iron cause less friction, and are much cheaper: there are two, one at each end, to diminish the friction of the axle-tree against the nave.

NAVIGATION, the theory and art of conducting a ship by sea, from one port to another, or of disposing and actuating her machinery, by the force of the wind, so as to begin and continue her motion at sea.

NAUMACHIA, in *antiquity*, a spectacle among the Romans, representing a sea-fight, as also the place where it was exhibited.

NAUTICAL planisphere, a description of the terrestrial globe upon a plane, for the use of mariners; but more usually called *chart*.

NAVY, implies, in general, any fleet or assembly of ships. It is, however, more particularly understood of the vessels of war that belong to a kingdom or state.

NAVY-board, together with its civil and military departments, consists of a lord high admiral, or lords commissioners for executing this office; one first lord commissioner, and six other lord commissioners, with a number of inferior officers, and clerks.

NAVY, is also a collective body of officers employed in his majesty's sea-service.

NECESSARIES, in a *military sense*, implies, for each soldier, 3 shirts, 2 white stocks, 1 black hair-stock, one pair of brass clasps for ditto, 3 pair of white yarn stockings, 2 pair of linen socks, dipped in oil, to be worn on a march; 2 pair of white linen gaiters, if belonging to the guards; 1 pair of black long gaiters, with black leather tops for ditto; 1 pair of half spatterdashes, 1 pair of linen drawers, 1 pair of red skirt breeches, 1 red cap, 1 cockade, 1 knapsack, 1 haversack, 1 pair of shoe-buckles, 1 pair of gaiter-buckles, black leather garters, 2 pair of shoes, 1 oil-bottle, 1 brush and picker, 1 worm, 1 turn-key, 1 hammer-cap, and 1 stopper. See **REGIMENTALS**.

NEUTRALITY, in *military history*, a state of indifference, in which a person, army, or state, avoids both friendship and hostility.

NITRE: See **SALTPETRE**.

NON-commissioned officer. See **OFFICER**.

O B L

OBLIQUE *defence*, that which is under too great an angle, as is generally the defence of the second flank, which can never be so good as a defence in front, nor approved of by skilful officers. See *Oblique FIRING*, at the word *FIRINGS*.

OBUS. See *HOWITZER*.

OCTAGON, in *fortification*, is an eight-sided figure, or a place that has eight bastions. See *FORTIFICATION*.

OFFICERS, in a *military sense*, are of several denominations and ranks, viz.

Commissioned OFFICERS, are those appointed by the king's commission; such are all from the general to the cornet and ensign.

Warrant OFFICERS, those who have no commissions, only warrants from such boards, or persons, who are authorized by the king to grant them.

Non-commissioned OFFICERS, are serjeant-majors, quarter-master-serjeants, serjeants, corporals, drum and fife-majors, who are nominated by their respective captains, and appointed by the commanding-officers of regiments, and by them reduced without a court-martial.

General OFFICERS, are those whose command is not limited to a single company, troop, or regiment; but extends to a body of forces, composed of several regiments: such are the general, lieutenant-general, major-general, and in some armies brigadier-general.

Field OFFICERS, are such as command a whole regiment; as the colonel, lieutenant-colonel, and major.

Staff OFFICERS, are the quarter-master-general, and the adjutant-general, who are strictly said only to exist in time of war; also the quarter-masters, adjutants, surgeons, and chaplains of regiments. See *STAFF*.

Subaltern OFFICERS, are lieutenants, cornets, and ensigns.

Flag OFFICERS, are admirals who hoist flags at the mast-heads.

Sea OFFICERS, are, in general, all those who have any command in the navy.

OGEE, in pieces of ordnance, an ornamental moulding, in the shape of an S, taken from architecture, and used in guns, mortars, and howitzers. See *CANNON*.

O R D

OLYMPIAD, in *chronology*, the space of four years, for on the fifth the olympic games were celebrated in honour of Jupiter Olympius, near Olympia. The Greeks began to use this epocha a little before the building of Rome.

OLYMPIC games, were instituted by Hercules, A. M. 2856, in honour of Jupiter Olympius, at Olympia, a city of Elis, in Peloponnesus. They were celebrated every 4 years, about the summer solstice. The design of them was to accustom the young military men to running, leaping, and every other military exercise.

OPEN flank, in *fortification*, that part of the flank, which is covered by the orillon. See *FORTIFICATION*.

OPENING of trenches, the first breaking of ground by the besiegers, in order to carry on their approaches towards the place.

ORDERS, in a *military sense*, all that is lawfully commanded by superior officers. Orders are given out every day, whether in camp, garrison, or on a march, by the commanding-officer; which orders are afterwards given to every officer in writing by their respective serjeants.

ORDER of battle. See *BATTLE*.

ORDERLY serjeant, } are appointed to at-
ORDERLY men, } tend general officers, or such other officers who are entitled to such, who walk behind them with their arms.

ORDERLY book. Every company has such a book for the serjeants to write down both general and regimental orders, for the officers to read them.

Military ORDERS, are companies of knights, instituted by kings and princes; either for defence of the faith, or to confer marks of honour on their military subjects. They are as follow:

Amaranth, an order of military knighthood, instituted in Sweden, by queen Christina, in 1645, at the close of an annual feast, celebrated in that country, and called *Wirtschafft*. Their device was the cypher of *Amarante*, composed of two *A's*, the one erect, the other inverted, and interwoven together; the whole inclosed by a laurel crown, with this motto, *Dolce nella memoria*.

Argonauts of St. Nicolas, was the name of a military order, instituted by Charles III. king of Naples, in the year 1382, for the advancement of navigation, or, as some authors say, merely for preserving amity among the nobles. They wore a collar of shells, inclosed in a silver crescent, whence hung a ship with this device, *Non credo tempori*.

ORDER of Calatrava, a Spanish military order. It was instituted in 1130 by Don Santio, of Toledo. The habit of these knights is a black garment, with a red cross upon the breast.

ORDER of Alcantara, a Spanish military order. It was established by Ferdinand the second, king of Leon and Castile, in 1170. They wore a green cross upon their garment.

ORDER of St. James, instituted by Ferdinand II. in 1175. These knights had the privilege of wearing their hats in the chapter, in the presence of their sovereign.

ORDER of St. Michael, instituted in 1469, by Lewis XII. in honour of the important services done to France by that archangel at the siege of Orleans, where he is supposed to have appeared at the head of the French troops, disputing the passage of a bridge, and repulsed the attack of the English, whose affairs ever after declined in that kingdom. The order is a rich collar, with the image of that saint pendent thereto; with this inscription: *Immensi tremor oceani*.

ORDER of the Holy Ghost, instituted by Henry II. of France, in 1578. The number of knights are 100, besides the sovereign, who is always grand master.

Order of St. Louis, instituted by Louis XIV. in the year 1693. This order has remained entirely in the possession of military men, ever since its institution, and has been of singular use in keeping up the spirit, and rewarding the services, of those who have distinguished themselves. The number of knights is unlimited, being given to every man of merit. The order is a golden cross, with eight points, which hang pendent to a broad crimson ribband. The motto is *Bellicæ virtutis præmium*.

ORDER of Mount Carmel, instituted by Henry IV. in 1608.

ORDER of St. Lazarus, is of a very early institution, but has been often neglected, and as often revived, 'till Louis XV. united the order of St. Carmel and St. Lazarus in April 1722. The king is sovereign, chief, founder, and protector.

ORDER of the knights of Malta. See MALTA.

ORDER of the knights of the Garter. See GARTER.

ORDER of the knights of the Bath. See BATH.

ORDER of the golden fleece, instituted by Philip duke of Burgundy, surnamed the Good, in 1429. See FLEECE.

ORDER of the annunciation, instituted by Amadeo, count of Savoy, surnamed the Green, in memory of Amadeo, the first earl, who had valorously defended the island of Rhodes against the Turks. The collar belonging to this order is of gold, and on it these four letters, *F. E. R. T.* which means *Fortitudo ejus Rhodum tenuit*, with the figure of the Annunciation hanging to it.

ORDER of knights templars, instituted at Jerusalem about the year 1118. At first there were but 9 of the order, and the two principal persons were Hugo de Paganis, and Jeoffroy of St. Omer's. This order, after having performed many great exploits against the infidels, became rich and powerful all over Europe; when, on the 22d of May, 1312, the pope, by his bull, pronounced the extinction of the order, and united their estates to the order of St. John of Jerusalem. They took the name of templars, because their first habitation stood near the temple dedicated to our Saviour at Jerusalem.

ORDER of knights of St. Jago, instituted by king Ranico, of Spain, in commemoration of a victory obtained against the Moors, anno 1030. Their ensign is a red cross in form of a sword.

ORDER of knights of the band, erected by Alphonso, king of Spain, in the year 1268. Their name proceeded from the knights wearing a red scarf, or lace of silk, the breadth of 3 inches, which hung on their left shoulder.

ORDER of knights of the Redemption, erected in the kingdom of Arragon, by king James, who conquered the island of Majorca, in the year 1212. Their garments are white, with a black cross thereon.

ORDER of Teutonic knights, established towards the close of the 12th century, and thus called, as chiefly consisting of Germans, anciently called Teutons.

ORDER of the knights of St. Stephen, instituted in the year 1561, by Cosmo, duke of Florence. They wear a red cross with a border of gold.

ORDER of merit, instituted by Frederic III, king of Prussia, as a reward to those officers whose behaviour deserved some marks of distinction,

function. The ensign of this order is a golden star of eight rays, enamelled with blue, which is worn appendant to a black ribbon, edged with silver; and the motto is *Pour le mérite*.

ORDER of St. Alexander Newski, or the red ribbon, which was instituted by Peter I. emperor of Russia; but the czarina Catharine I. conferred it in the year 1725.

ORDER of the stole, an order of knights instituted by the kings of Arragon.

ORDER of the golden stole, a Venetian military order, so called from a golden stole, which those knights wore over their shoulder, reaching to the knee, both before and behind, a palm and a half broad. None are raised to this order but patricians, or noble Venetians. It is uncertain when this order was instituted.

ORDNANCE, a name given to all that concerns artillery: thus, the commander in chief is called master-general of the *ordnance*; the lieutenant-general of the *ordnance*, instead of *artillery*.

Board of ORDNANCE, is of a very early, but uncertain date; however, in the year 1548, we find Sir Philip Hoby styled master of the ordnance; and in 1588, Ambrose Dudley, earl of Warwick, was master of the ordnance. In 1683, the care of the office of ordnance was committed to five principal officers, besides the master-general, then George lord Dartmouth, viz. a lieutenant-general, surveyor-general, clerk of the ordnance, store-keeper, and a clerk of deliveries. At present the board of ordnance consists of the same. This board deliberates, regulates, and orders every thing relating to the artillery and garrisons.

Master-general of the ORDNANCE, is an office of the greatest trust, honour, and dignity: it is one of the most laborious employments in war, and requires the greatest ability, application, and experience. This officer has the sole command of the royal regiment of artillery, assisted by a lieutenant-general. By the great power invested in the master-general by the king, he alone constitutes a board. This post is of much greater antiquity in France than with us; for history informs us, that in the year 1358, John de Lion was appointed first master of artillery. This title continued 'till the year 1397, when John de Soifi was appointed master-general of artillery. This title continued 'till the year 1599, when Maximilian de Bethune, marquis de Reims, duke de Sully, and marshal of France, was appointed first grand master and captain-general of artillery. This title continued 'till the year 1755, when the marquis de Sabrevois was appointed grand

master of artillery, which title continues to this day.

In 1548, Sir Philip Hoby was styled master of the ordnance.

In 1587, we find Ambrose Dudley, earl of Warwick, styled master of the ordnance, and had under him a master-gunner and a trench-master.

In 1596, the 29th of March, the earl of Essex was master of the ordnance.

In 1603, the earl of Devon was first called general of the ordnance.

In	1609, 27th June, the earl of Totness, ditto. 1617, 5th May, lord Vere. 1623, 26th Aug. Sir Richard Morison. 1628, Sir Thomas Stafford. 1634, 2d Sept. the earl of Newport. 1660, 22d Jan. Sir William Compton. 1664, 21st Oct. Sir Tho. Chichelev, knt. first called master-general of the ordnance. 1681, 28th Jan. lord Dartmouth. 1689, 28th April, David Schomberg, esq; 1693, 28th July, lord viscount Sidney. 1702, 29th June, earl of Marlborough. 1711, 10th Jan. earl Rivers. 1712, 5th Sept. duke of Hamilton. 1714, 4th Oct. John duke of Marlborough. 1722, 30th June, William earl of Cadogan. 1725, 3d June, John duke of Argyll and Greenwich. 1730, 10th May, John duke of Montagu. 1755, 10th May, Charles duke of Marlborough. 1757, 30th Nov. John lord visc. Ligonier. 1763, 30th Nov. marquis of Granby. 1772, 30th Nov. George lord viscount Townshend.
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Honours due to the master-general of the ORDNANCE. The same respect shall be paid to him from the troops, as is paid to generals of horse and foot; that is, on all occasions, to have the march beat to him; and to be saluted by all officers, the colours excepted.

Lieutenant-general of the ORDNANCE, is an officer of great trust, honour, and dignity; is the next in command under the master-general, and always an officer of the greatest abilities. This office is not of such early date as that of the master-general; for in 1597, it was first established, and has continued as follows, viz.

In	1547, Sir George Carew, knight. 1635, Sir William Hayden. 1636, 28th June, Colin Legge, esq; 1670, 21st Nov. David Walter, esq; 1672, 7th Dec. George Legge, esq;
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In 1681, 28th Jan. Sir Charles Musgrave.
 1687, 1st Aug. Sir Thomas Tichbourn.
 1688, 26th April, Sir Hugh Goodrick.
 1702, 29th June, James Granville, esq;
 1705, 2d May, Thomas Earle, esq;
 1712, 21st June, James Hill, esq;
 1714, 20th Sept. Thomas Earle, esq;
 1717, 19th March, Tho. Micklethwaite, esq;
 1718, 22d April, Sir Charles Willis.
 1742, 22d April, field-marshal Wade.
 1748, 22d April, Sir John Ligonier.
 1757, 30th Nov. lord George Sackville.
 1759, 10th Sept. marquis of Granby.
 1763, 10th Sept. George lord viscount Townshend.
 1767, 10th Sept. right hon. Henry Seymour Conway.
 1772, 10th Sept. Sir Jeffery Amherst, knight of the Bath; now lord Amherst.

Surveyor-general of the ORDNANCE, is the third person who constitutes that board: it is a civil employment, of great trust, having the superintendence of the artillery proofs, military buildings, &c.

ORGUES, thick long pieces of wood, pointed and shod with iron, clear one of another, hanging perpendicularly each by a rope, over the gate of a strong place, to be dropped in case of emergency.

Their disposition is such, that they stop the passage of the gate, and are preferable to *berfes* or *portcullises*; because these may be either broken by a petard, or stopped, by different contrivances, in their falling down. But a petard is useless against an *orgue*; for if it break one or two of the pieces, others immediately fall down and fill up the vacancy.

ORGUES, a number of harquebusses linked together, or diverse musket-barrels laid in a row, so that they may be discharged all at once, or separately.

ORTHOGRAPHY. See **PROFILE**.

ORILLON. See **FORTIFICATION**.

ORTEIL. See **BERM**, and **FORTIFICATION**.

OVERSLAGH, as a *military phrase*, which is derived from the Dutch, will be better explained by the following table. For instance, suppose 4 battalions, each consisting of 8 captains, are doing duty together, and that a

captain's guard is daily mounted: if, in the buffs, the second captain is doing duty of deputy-adjutant-general; and the 4th and 7th captains in the king's are acting, one as aid-de-camp, the other as brigade-major; the common duty of these three captains must be *overslagbed*, that is, slipped over, or equally divided among the other captains.

TABLE of explanation.

Regiments	N ^o . of captains	Heads of each column.							
		1	2	3	4	5	6	7	8
Royal	8	1		8	2	15	19	23	26
Queen's royal	8		6	9	13	16	20	24	27
Old-buffs	8	3		10	14	17	21	25	28
King's own	8	4	7	11		18	22		19
Total	32								

OUT-posts, in a *military sense*, a body of men posted beyond the grand guard, called out-posts, as being without the rounds or limits of the camp. See **Posts**.

OUT-works, in *fortification*, are works of several kinds, which cover the body of the place, as ravelins, half-moons, tenailles, horn-works, crown-works, counterguards, envelopes, swallows-tails, lunettes, covert ways, glacis, &c.

These out-works, not only cover the place, but likewise keep an enemy at a distance, and hinder his gaining any advantage of hollow or rising grounds; as such cavities and eminences may serve for lodgements to the besiegers, facilitate the carrying on approaches, and raising their batteries against the town. When out-works are placed one before another, you will find a ravelin before the curtain, a horn-work before the ravelin, and a small ravelin before the curtain of the horn-work; then the nearest to the body of the place must be the highest, though lower than the body of the place, that they may gradually command those without them, and oblige the enemy to dislodge, if in possession of them.

P A C

PACE, in a *military sense*, a measure used in fortification: it is a measure taken from the space between the two feet of a man in walking, usually reckoned $2\frac{1}{2}$ feet, and in some men 3 feet.

Geometrical PACE, is 5 feet; 60,000 of which make one degree of the equator.

PAGEANT, in *ancient military history*, a triumphal car, chariot, arch, or other like pompous decoration, variously adorned with colours, flags, &c. carried about in public shows, processions, &c.

PALÆSTRA, in *Grecian antiquity*, a public building, where the youth exercised themselves in the military art, wrestling, running, playing at quoits, &c.

PAILS, made of wood, with iron hoops and handles, hold generally 4 gallons, and serve in the field to fetch water for the use of artillery works, &c.

PAILLASSE, in *military history*, is a French word, adopted and used in our language by the military: it implies a canvass or sail-cloth bed-case, stuffed with straw; literally, a straw-bed.

PALISADES, in *fortification*, stakes made of strong split wood, about 9 feet long, 6 or 7 inches square, 3 feet deep in the ground, in rows about $2\frac{1}{2}$ or 3 inches asunder, placed in the covert-way, at 3 feet from and parallel to the parapet or side of the glacis, to secure it from surprise.

They are also used to fortify the avenues of open forts, gorges, half-moons, the bottoms of ditches, and, in general, all posts liable to surprise. They are usually fixed perpendicularly, though some make an angle inclining towards the ground next the enemy, that the ropes cast over them, to tear them up, may slip off.

Turning PALISADES, are an invention of Mr. Coehorn, in order to preserve the palisades of the parapet of the covert-way from the besiegers shot. They are so ordered, that as many of them as stand in the length of a rod, or about 10 feet, turn up and down like traps, so as not to be in sight of the enemy, 'till they just bring on their attack; and yet are always ready to do the proper service of palisades.

PANDOURS, are Hungarian infantry: they wear a loose garment fixed tight to their bodies by a girdle, with great sleeves, and large breeches reaching down to their ancles. They use fire-arms, and are excellent marksmen: they also wear a kind of sabre, near 4 feet long, which they use with great dexterity.

P A R

PANNELS, in *artillery*, are the carriages which carry mortars and their beds upon a march.

PARABOLA, in *geometry*, a figure arising from the section of the cone, when cut by a plane parallel to one of its sides.

From the same points of a cone, therefore, only one parabola can be drawn; all the other sections within these parallels being ellipses, and all without hyperbolas.

Properties of the PARABOLA. The square of an ordinate is equal to the rectangle of the abscissa, and four times the distance of the focus from the vertex.

The perpendicular on the tangent, from the focus, is a mean proportional between the distance from the vertex to the focus, and the distance of the focus from the point of contact.

All lines within the parabola, which are drawn parallel to the axis, are called diameters.

The parameter of any diameter is a right line, of such a nature that the product under the same, and the abscissa, is equal to the square of the semi-ordinate.

The squares of all ordinates to the same diameter, are to one another as their abscissas.

Cartesian PARABOLA, is a curve of the second order, expressed by the equation $xy = ax' + bx^2 + cx + d$, containing 4 infinite legs, being the 66th species of lines of the third order, according to Sir Isaac Newton; and is made use of by Descartes, in the third book of his geometry, for finding the roots of equations of six dimensions by its intersections with a circle.

Diverging PARABOLA, a name given by Sir Isaac Newton to 5 different lines of the third order, expressed by the equation $yy = ax' + bx^2 + cx + d$.

PARADE, in a *military sense*, the place where troops assemble, or draw together, to mount guard, or for any other purpose.

PARADE, in *fencing*, implies the action of parrying, or turning off any thrust.

PARALLELS, at a siege, the trenches or lines made parallel to the defence of the place besieged: they are also called lines of communication, and boyaus.

PARALLELS, or places of arms, are deep trenches 15 or 18 feet wide, joining the several attacks together, serve to place the guard of the trenches in readiness to support the workmen when attacked. There are usually 3 in an attack; the 1st, about 300 toises from the covert-way; the 2d and 3d, nearer to the glacis.

PARAMETER. See GUNNERY, and PROJECTILES.

PARAPET, in *fortification*, an elevation of earth, designed for covering the soldiers from the enemy's cannon, or small shot: its thickness is from 18 to 20 feet; its height 6 on the inside, and 4 or 5 on that side next the country: it is raised on the rampart, and has a slope called the superior talus, or glacis of the parapets, on which the troops lay their arms to fire over. The slope renders it easy for the soldiers to fire into the ditch. It has a banquette or two on the inside for the troops who defend it, to mount upon, for better discovering the country, the ditch, and counterescarp, to fire as they find occasion.

PARAPET of the covert-way, is what covers that way from the sight of the enemy; which renders it the most dangerous place for the besiegers, because of the neighbourhood of the faces, flanks, and curtains of the place.

PARK of artillery. See ARTILLERY-PARK.

PARK of provisions, the place where the soldiers pitch their tents in the rear, and sell provisions to the soldiers. Likewise that place where the bread-waggons are drawn up, and where the troops receive their ammunition-bread, being the store of the army.

PARLEY, in *military matters*, means a conference with an enemy.

To beat a PARLEY, is to give a signal for holding such a conference, by beat of drum, or sound of trumpet. See CHAMADE.

PAROLE, in a *military sense*, the promise made by a prisoner of war, when he has leave to go any where, of returning at a time appointed, if not exchanged.

PAROLE, means also a word given out every day in orders by the commanding officer, both in camp and garrison, in order to know friends from enemies.

PARTISAN, in the *art of war*, a person dexterous in commanding a party; who, knowing the country well, is employed in getting intelligence, or surprising the enemy's convoy, &c. The word also means an officer sent out upon a party, with the command of a body of light troops, generally under the appellation of the partisan's corps. It is also necessary that this corps should be composed of infantry, light-horse, and hussars.

PARTY, in a *military sense*, a small number of men, horse, or foot, sent upon any kind of duty; as into an enemy's country, to pillage, to take prisoners, and oblige the country to come under contribution. Parties are often sent out to view the roads and ways, get intelligence, seek forage, reconnoitre, or amuse

the enemy upon a march; also frequently sent upon the flanks of an army, or regiment, to discover the enemy, if near, and prevent surprise or ambuscade.

PARRYING, in *fencing*, the action of warding off the push or blow aimed at one by another. See FENCING.

PASS, in a *military sense*, a strait, difficult, and narrow passage, which shuts up the entrance into a country.

PASS, } in *fencing*, an advance or leap.
PASSADE, } forward upon the enemy.

PASSADE, in the *manage*, is a horse's walking or trotting in such a manner, that he raises the outward hind-leg and the inward fore-leg together; and, setting these two on the ground, raises the other two alternately, never gaining above a foot of ground at a time.

PASS-parole, in *military affairs*, a command given at the head of an army, and thence communicated to the rear, by passing it from mouth to mouth.

PASS-port, or **PASS**, in *military matters*, a licence or writing obtained from a prince or governor, &c. granting liberty and safe conduct to pass through his territories without molestation.

PASS-volant, } in a *military sense*, the same

PASSE-volant, } with faggot. See FAGGOT.

PATE'E, in *fortification*, a small work resembling a horse-shoe; that is, an elevation of earth, of an irregular form, generally oval, with a parapet. It is frequently raised in marshy grounds, to cover the gate of a place, having only a direct defence, but nothing to flank it.

PATROL, in *war*, rounds made by the different guards, in the night-time, to observe what passes in the camp, out-posts, streets, centries, &c. to secure the peace and tranquillity of a city or camp; as also to keep all on duty alert. The patrol generally consists of 6 or 12 men and a serjeant.

They go every hour in the night from the beating of the tattoo until the reveille: they are to walk in the streets in garrisons, and all over the camp in the field, to prevent disorders, or any number of people from assembling together: they are to see the lights in the soldiers barracks put out, and to take up all the soldiers they find out of their quarters.

Sometimes *patrols* consist of an officer and 30 or 40 men, as well infantry as cavalry; but then the enemy is generally near at hand, and consequently the danger greater.

PAVILION, in *military affairs*. See TENT.

PAY, or *pay of the army*, is the stipend or salary allowed for each individual serving in the army; first established by government in the year 1660, and not altered since.

PAY

PAY

Daily pay of each rank in the horse and grenadier-guards.	Horse-guards		Grenadier-guards	
	Full-pay	Subsist.	Full-pay	Subsist.
Captain and colonel	1 16 0	1 7 0	1 10 0	1 2 6
Lieutenant and lieutenant-colonel	1 11 0	1 3 3		
	1 7 0	1 0 6	1 2 6	1 17 0
Cornet and major, H. G. major in G. G.	1 6 0	0 19 6	1 0 0	0 15 0
Guidon and major	1 4 0	0 18 0		
Exempt and Capt. H. G. Lieut. and Capt. G. G.	0 16 0	0 12 1	0 17 0	0 13 0
Brigadier and lieut. H. G. sub-lieut. G. G.	0 11 0	0 8 2	0 10 0	0 7 6
Guidon and captain			0 16 0	0 12 0
Sub-brigadier and cornet	0 6 0	0 4 0		
Chaplain	0 6 8	0 5 0	0 6 8	0 5 5
Adjut. and lieut. H. G. sub-lieut. and adj. G. G.	0 11 0	0 8 0	0 7 0	0 5 6
Surgeon	0 8 0	0 6 0	0 8 0	0 6 0
Quarter-master H. G. serjeant G. G.	0 6 0	0 4 9	0 4 0	0 3 6
Corporal	0 5 0	0 3 9	0 3 0	0 2 6
Trumpeter and kettle-drum H. G. haut-boys or drum G. G.	0 5 0	0 4 0	0 2 6	0 2 0
Private man	0 4 0	0 2 1	0 2 6	0 2 0

Besides the pay, as above, there are warrant-men allowed on the establishment, viz. to a colonel 6, to a lieutenant colonel 3, to a major 2, to a captain, sub-lieutenant, adjutant, and clerk, 1 each; to agent H. G. 2, to G. G. 3; riding-

master H. G. 1, to G. G. 2: allowance to the purveyor and rough-rider 1s. each.

N. B. The fractions, as being inconsiderable, are omitted.

Daily pay of each rank in his majesty's land-forces. British.	Royal reg. of horse-guards		Dragoons		Foot-guards		Foot	
	F. pay	Subsist.	F. pay	Subsist.	F. pay	Subsist.	F. pay	Subsist.
Colonel	2 1 0	1 11 0	1 15 0	1 6 6	1 19 0	1 10 0	1 4 0	0 18 0
Lieutenant-colonel	1 9 6	1 2 6	1 4 6	0 18 6	1 8 6	1 1 6	0 17 0	0 13 0
Major	1 7 0	1 1 6	1 0 6	0 15 6	1 4 6	0 18 6	0 15 0	0 11 6
Captain	1 1 6	0 16 0	0 15 6	0 11 6	0 16 6	0 12 6	0 10 0	0 7 6
Capt. lieut. or lieut.	0 15 0	0 11 6	0 9 0	0 7 0	0 7 10	0 6 0	0 4 8	0 3 6
Cornet H. G. and drag.	0 14 0	0 11 0	0 8 0	0 6 0	0 5 10	0 4 6	0 3 8	0 3 0
Enf. F. G. E. or 2 L. F.								
Chaplain	0 6 8	0 5 0	0 6 8	0 5 0	0 6 8	0 5 0	0 6 8	0 5 0
Adjutant, or solicitor	0 5 0	0 4 6	0 5 0	0 4 6	0 4 0	0 3 0	0 4 0	0 3 0
Quarter-master	0 8 6	0 6 6	0 5 6	0 4 0	0 4 0	0 3 0	0 4 8	0 3 6
Surgeon	0 6 0	0 4 6	0 6 0	0 4 6	0 4 0	0 3 0	0 4 0	0 3 0
Surgeon's mate					0 3 0	0 3 0	0 3 6	0 3 0
Drum-major					0 1 0	0 1 0		
Deputy-marshal					0 1 0	0 0 9		
Serjeant			0 2 9	0 2 3	0 1 10	0 1 4	0 1 6	0 1 0
Corporal	0 3 0	0 2 6	0 2 3	0 1 9	0 1 2	0 0 10	0 1 0	0 0 8
Kettle-drum	0 3 0	0 2 6						
Drummer	0 3 0	0 2 6	0 2 3	0 1 9	0 1 2	0 0 8	0 1 0	0 0 8
Trumpeter	0 2 8	0 2 0						
Private man	0 2 6	0 2 0	0 1 9	0 1 5	0 0 10	0 0 6	0 0 8	0 0 6

Besides the pay the following allowances are made: To the colonel of the royal regiment of horse-guards 4s. per day; dragoons 2s. 6d. foot-guards 1s. 7½d. foot 1s. 2d. To the captains of the horse-guards 4s. dragoons 4s. foot-guards 1s. 1½d. foot 1s. per day.

P A Y

Daily pay of the roy. reg. of artillery	Full pay		Arrears	
	Pay	Subst.	per day	per ann.
Serjeants	0 2 0	0 1 7½	0 0 4½	6 9 3½
Corporals	0 1 10	0 1 6½	0 0 3½	5 6 5½
Bombardier	0 1 8	0 1 4½	0 0 3½	5 6 5½
Gunners	0 1 4	0 1 1½	0 0 2½	4 3 7½
Matrosies	0 1 0	0 0 9½	0 0 2½	3 16 0½
Fifers	0 1 0	0 0 9½	0 0 2½	3 16 0½
Drummers	0 1 0	0 0 9½	0 0 2½	3 16 0½

N. B. The officers are the same as the foot in the preceding table.

PAY-master, is he who is intrusted with the money, and has the charge of paying the company.

PEACE, a state of tranquillity, and generally used in opposition to war. See **WAR**.

PEDREFO. See **MORTAR**.

PENDULUM, in *mechanics*, any heavy body so suspended, as that it may vibrate backwards and forwards, about some fixed point, by the force of gravity.

A pendulum is any body, as *B* (Pl. X. fig. 6.) suspended upon, and moving about, a point *A* as a centre. The nature of a pendulum consists in the following particulars. 1. The times of the vibrations of a pendulum, in very small arches, are all equal. 2. The velocity of the bob, in the lowest point, will be nearly as the length of the cord of the arch which it describes in the descent. 3. The times of vibrations in different pendulums, *AB*, *AC*, are the square roots of the times of their vibrations. 4. The time of one vibration is to the time of descent, through half the length of the pendulum, as the circumference of a circle is to its diameter. 5. Whence the length of a pendulum, vibrating seconds in this latitude, will be found to be 39 inches and 2-10ths; and of one half-second pendulum 9.8 inches. 6. An uniform homogeneous body *BG* (Pl. X. fig. 7.) as a rod, staff, &c. which is 1-3d part longer than a pendulum *AD*, will vibrate in the same time with it.

From these properties of the pendulum, we may discern its use as an universal chronometer, or regulator of time. By this instrument, also, we can measure the distance of a ship, of a battery, &c. by measuring the interval of time between the fire and report of the gun; also the distance of a cloud, by counting the seconds or half-seconds, between the lightning and the thunder. Thus, suppose between the lightning and thunder we count 10 seconds; then, because sound passes through 1142 feet in one second, we get the distance of the cloud = 11420 feet. Again, the height of any room, or other object, may be measured by a pendulum vibrating from the

P E R

top thereof. Thus, suppose a pendulum from the height of a room, or other object, vibrates in three seconds; then say, as 1 is to the rate of 3, viz. 9, so is 39.2 to 352.8 feet, the height required. Lastly, by the pendulum we discover the different force of gravity on divers parts of the earth's surface, and thence the true figure of the earth.

PENSIONS for officers widows. Colonel's widow 50l. lieutenant's 40l. major's 30l. captain's 26l. lieutenant's 2cl. ensign's 16l. cornet's 16l. adjutant's 16l. quarter-master's 16l. surgeon's 16l. and chaplain's 16l.

PENSIONERS, or *band of gentlemen pensioners*, raised in 1509 by king Henry VIII. to guard his person. They consist of a captain, lieutenant, standard-bearer, clerk of the cheque, and 40 gentlemen pensioners, with a salary of 100l. a year each. They have also a paymaster, harbinger, ax-keeper, and messenger.

PENTAGON, in *fortification*, a figure bounded by 5 sides, or polygons, which form so many angles, capable of being fortified with an equal number of bastions. It also denotes a fort with 5 bastions.

PERCH, in mensuration, is 10 feet long. See **MEASURE**.

PERCUSSION, in *physics*, the impression a body makes in falling or striking another; or the shock of two moving bodies: and it is either direct or oblique.

Direct PERCUSSION, is where the impulse is given in the direction of a right line perpendicular to the point of contact.

Oblique PERCUSSION, when it is given in the direction of a line oblique to the point of contact.

Centre of PERCUSSION, of a body in motion, is that point in which all the forces of the same are considered as united together in one; so that, if the said body meets any obstacle contrary to the motion thereof, it strikes the obstacle with a greater force than any other point of the body; and consequently, if the percutient body revolves round a fixed point, and in its motion strikes any obstacle with its centre of percussion, it will, during a small particle of time, preserve an equilibrium about that point.

Let the inflexible right line *PB* (Pl. XIII. fig. 4.) with two given weights *A*, *B*, suspended at the point *A* and *B*, revolve about the fixed point *P*, as a centre; and let it be required to determine the centre of percussion *C*, of the said weights.

Put $BC = x$; then $CA = BA - x$. The velocity with which *B* revolves, is as *PB*; therefore its force may be expressed $PB \times B$; and by the same way of reasoning, the force of *A* may be expounded by $PA \times A$: therefore,

by

P E R

by the above definition of the centre of percussion, we have $PB \times B \times x = BA - x \times PB \times PA \times A$

$PA \times A$; hence $x = \frac{PB \times B + PA \times A}{PB \times B + PA \times A}$;

subtract this from PB , and we have PC , or the distance of the centre of percussion from

the point of suspension P , $= \frac{PA^2 \times A + PB^2 \times B}{PA \times A + PB \times B}$

If there were three, or a greater number of weights affixed to the rod PB , the distance of their centre of percussion from the point of suspension would, in like manner, be found by first multiplying each weight into the square of its distance from the point of suspension, and dividing the sum of these products by that of the products arising from the multiplication of each weight into its respective distance, from the point of suspension. Hence it appears that the centre of percussion is the same with the centre of oscillation.

PERPENDICULAR, in *geometry*, a line falling directly upon another line, so as to make equal angles on each side.

PERDUE, in *war*, denotes the forlorn hope; and *to lie perdue*, is to lie flat and closely in wait.

PERSPECTIVE, is the art of drawing the resemblances or pictures of objects on a plane surface, as the objects themselves appear to the eye, &c.

PETARD, in *war*, an engine to burst open the gates of small fortresses: it is made of gun-metal, fixed upon a board two inches thick, and about $2\frac{1}{2}$ feet square, to which it is screwed, and holds from 9 to 20 pounds of powder, with a hole at the end opposite to the plank to fill it, into which the vent is screwed: the petard thus prepared is hung against the gate by means of a hook, or supported by three staves fastened to the plank: when fired, it bursts open the gate. Its invention is ascribed to the French Huguenots in 1579, who, with them, took Cahors in 1579.

PETARDIER, he who loads, fixes, and fires the petard.

PETITE-GUERRE, is carried on by a light party, commanded by an expert partisan, and which should be from 1000 to 2000 men, separated from the army, to secure the camp or a march; to reconnoitre the enemy or the country; to seize their posts, convoys, and escortes; to plant ambuscades, and to put in practice every stratagem for surprising or disturbing the enemy; which is called carrying on the *Petite-guerre*. The genius of these days, and the operations of the last war, have placed the service of such a corps in a most respectable

P I C

light, as it is more fatiguing, more dangerous, and more extensive.

To form a corps capable of carrying on the *Petite-guerre* to advantage, prudence requires that it should consist of 1000 men at least, without which a partisan cannot expect to support the fatigues of a campaign, and seize the most important occasions that every where offer, and which a too great inferiority must make him forego.

It is no less important that this corps should be composed of infantry and cavalry; and as it is incontestible that the cavalry should be the most active in carrying on the *Petite guerre*, it were to be wished that they were likewise the strongest, so as to have 600 cavalry and 400 infantry in a corps of 1000 men, making 4 companies of infantry, and 12 troops of cavalry. Each company of infantry to consist of 1 captain, 1 first and 2 second lieutenants, 4 serjeants, and 96 men, including 4 corporals, 4 lance corporals, and 2 drummers. Each troop of cavalry to consist of 1 captain, 1 first and 1 second lieutenant, a quarter-master, 2 serjeants, and 48 horsemen; including 4 corporals, a trumpeter and farrier.

The commanding-officer should have the naming of the officers of this corps, or at least the liberty to reject such as he is convinced are not qualified for such service. To support the honour of this corps upon a solid and respectable footing, the strictest subordination must extend from the chief to all the officers, and the most rigid discipline inspire vigilance, patience, bravery, and love of glory in the whole corps.

PHALANX, in *ancient military history*, a large square battalion of infantry, joined close together, with their shields in close order, and pikes turned cross-ways. The phalanx was a form peculiar to the Macedonians: the front exceeded the depth, and the depth consisted generally of 16 men.

PICKETS, in *fortification*, stakes sharp at one end, and sometimes shod with iron, used in laying out the ground, of about 3 feet long; but, when used for pinning the fascines of a battery, they are from 3 to 5 feet long.

PICKETS, in *artillery*, are about 5 or 6 feet long, shod with iron, to pin the park lines, in laying out the boundaries of the park.

PICKETS, in the *camp*, are also stakes of about 6 or 8 inches long, to fasten the tent cords, in pitching the tents; also, of about 4 or 5 feet long, driven into the ground near the tents of the horsemen, to tie their horses to.

PICKET, an out-guard posted before an army, to give notice of an enemy approaching. See **GUARD**.

PICKET, a kind of punishment so called, where

where a soldier stands with one foot upon a sharp-pointed stake: the time of his standing is limited according to the offence.

PIECES, signify cannon of all denominations. See **CANNON**.

Regimental PIECES, are light 3 and 6-pounders: each regiment has generally two of these pieces.

Field-PIECES, are light 3, 6, and 12-pounders. See **CANNON**.

Battering-PIECES, are heavy, 12, 18, and 24-pounders, used in sieges for battering the works of a fortification. See **CANNON**.

Garrison-PIECES, are mostly heavy 6, 9, 12, 18, 24, 36, and 42-pounders, besides wall-guns.

PIKE, in *war*, an offensive weapon, consisting of a wooden shaft, 12 or 14 feet long, with a flat steel head, pointed, called the spear. This weapon was long in use among the infantry; but now the bayonet, which is fixed on the muzzle of the firelock, is substituted in its stead. It is still used by some of the officers of infantry, under the name of sponton. The Macedonian phalanx was a battalion of pike-men.

PILES of shot or shells, are generally piled up in the king's magazines, in three different manners: the base is either a triangular square, or a rectangle; and from thence the piles are called triangular, square, and oblong.

TABLE of triangular PILES of shot.

Side	Content	Side	Content	Side	Content	Side	Content
2	4	13	473	24	437	35	7486
3	10	14	574	25	751	36	8184
4	20	15	696	26	1091	37	9322
5	35	16	731	27	13458	38	10131
6	56	17	883	28	13853	39	10981
7	84	18	1043	29	14277	40	11871
8	120	19	1222	30	14731	41	12807
9	165	20	1540	31	15216	42	13730
10	220	21	1641	32	15733	43	14659
11	296	22	1883	33	16283	44	15585
12	384	23	2148	34	16867	45	16511

Explanation.---The numbers in the 1st, 3d, 5th, and 7th vertical columns, express the number of shot in the base or side of each triangular pile; and the numbers in the 2d, 4th, 6th, and 8th vertical columns, express the number of shot in each pile.

If the triangular prism *ABCD* of shot (*Pl. XIII. fig. 3.*) whose side *BD* or *AC*, is equal to the corner row *AB*, be cut diagonally by a plane *CF*, it is evident that the triangular pyramid *CFD*, is 1-3d of the prism; and the remainder *CFA*, the 2-3ds.

Now because the number of shot in the triangular base *ABC*, is expressed by the terms 1, 2, 3, 4, 5, &c. of the natural numbers, whose last term = *z*, the number of shot in the base *AC*; and the sum of all the terms, to the sum 1 + 2 of the first and last multiplied by $\frac{1}{2}$ *z* half their number; that is, to $\frac{1}{2} z \times z + 1$.

The base *ABC*, multiplied by *z*, the number of triangles contained in the prism *ABDC*, gives $\frac{1}{2} z z \times z + 1$ for its content, and $\frac{2}{3} z z \times z + 1$ of which, that of the part *AFC*. But it is evident, that the plane *CF* cuts the triangular range *CB* into two parts; the one, *CFB*, is for the same reason as above, $\frac{1}{3}$ of $\frac{1}{2} z \times z + 1$ that range, which third $\frac{1}{3} z \times z + 1$, will express the part *CFB*. This being added to $\frac{1}{2} z z \times z + 1$, found before gives $\frac{1}{2} z z \times z + 1 + \frac{1}{3} z \times z + 1$, or $\frac{5}{6} z \times z + 1 \times z z + 1$, when reduced under the same denomination, for the square pile *ABC*, or fig. 2. *ABCD*.

Rule I. Multiply the base by the base more 1, this product by the base more 2, and divide by 6.

Example I. Let the base or corner row of a complete triangular pile be 20; then $\frac{20 \times 21 \times 22}{6} = 10 \times 7 \times 22 = 1540$, for the number of shot required.

TABLE of square PILES of shot.

Side	Content	Side	Content	Side	Content	Side	Content	Side	Content
2	5	20	2871	38	19019	56	60116	74	137825
3	14	21	3311	39	20540	57	63365	75	143450
4	30	22	3795	40	22140	58	66729	76	149226
5	55	23	4324	41	23821	59	70210	77	155155
6	91	24	4900	42	25585	60	73810	78	161239
7	140	25	5525	43	27434	61	77531	79	167480
8	204	26	6201	44	29370	62	81375	80	173880
9	285	27	6930	45	31395	63	85344	81	180441
10	385	28	7714	46	33511	64	89440	82	187165
11	506	29	8555	47	35720	65	93665	83	194054
12	650	30	9455	48	38024	66	98021	84	201110
13	819	31	10416	49	40425	67	102510	85	208335
14	1015	32	11440	50	42925	68	107134	86	215734
15	1240	33	12529	51	45526	69	111895	87	223300
16	1496	34	13685	52	48230	70	116795	88	231044
17	1785	35	14910	53	51039	71	121830	89	238965
18	2109	36	16206	54	53953	72	127022	90	247065
19	2470	37	17575	55	56980	73	132349	91	255346

Explanation.

[To be placed opposite *Table of oblong*
PILES of shot, at the word *PILES*.]

	1	28	29	30	31	32	33	34	35	36	37	38
10	385	1878	1925	1980	2035	2090	2145	2200	2255	2310	2365	2420
11	506	2288	2354	2420	2486	2552	2618	2684	2750	2816	2882	2948
12	650	2756	2834	2912	2990	3068	3146	3224	3302	3380	3458	3536
13	819	3276	3367	3458	3549	3640	3731	3822	3913	4004	4095	4186
14	1015	3850	3955	4060	4165	4270	4375	4480	4585	4690	4795	4900
15	1240	4480	4600	4720	4840	4960	5080	5200	5320	5440	5560	5680
16	1496	5168	5304	5440	5576	5712	5848	5984	6120	6256	6392	6528
17	1785	5916	6069	6222	6375	6528	6681	6834	6987	7140	7293	7446
18	2109	6726	6897	7068	7239	7410	7581	7752	7923	8094	8265	8436
19	2470	7600	7790	7980	8170	8360	8550	8740	8930	9120	9310	9500
20	2870	8540	8750	8960	9170	9380	9590	9800	10010	10220	10430	10640
21	3311	9548	9779	10010	10241	10472	10703	10934	11165	11396	11627	11858
22	3795	10626	10879	11132	11385	11638	11891	12144	12397	12650	12903	13156
23	4324	11770	12052	12328	12604	12880	13156	13432	13708	13984	14260	14536
24	4900	13000	13300	13600	13900	14200	14500	14800	15100	15400	15700	16000
25	5525	14300	14625	14950	15275	15600	15925	16250	16575	16900	17225	17550
26	6201	15675	16029	16380	16731	17082	17433	17784	18135	18486	18837	19188
27	6930	17130	17514	17899	18270	18648	19026	19404	19782	20160	20538	20916
28	7714	18670	19082	19488	19894	20300	20706	21112	21518	21924	22330	22736
29	8555	20300	20735	21170	21605	22040	22475	22910	23345	23780	24215	24650
30	9455	22010	22475	22940	23405	23870	24335	24800	25265	25730	26195	26660
31	10416	23808	24304	24800	25296	25792	26288	26784	27280	27776	28272	28768
32	11440	25690	26224	26752	27280	27808	28336	28864	29392	29920	30448	30976
33	12529	27676	28237	28798	29359	29920	30481	31042	31603	32164	32725	33286
34	13685	29750	30345	30940	31535	32130	32725	33320	33915	34510	35105	35700
35	14910	31920	32550	33180	33810	34440	35070	35700	36330	36960	37590	38220
36	16206	34188	34854	35520	36186	36852	37518	38184	38850	39516	40182	40848

EXPLANATION. The head column from 1 to 38, the bottom row at the end. — *Example.* To know how many shot will be contained in such an oblong pile of 12, and opposite 15, will be 2560; the shot contained in such an oblong pile finished.

P I L

Explanation. The numbers gradually increasing, from 2 to 91, express the number of shot at the base of each square pile; and the numbers opposite, the quantity of shot in each complete square pile. *Example.* N°. 20 gives 2871, and N°. 30 gives 9455; and so of the rest.

Rule II. Multiply the corner row, by the corner row more 1; this product by twice the corner row more 1, and divide by 6.

Example II. Let the side *AC* (Pl. XIII. fig. 2.) of a complete square pile be 36; then

$$\frac{36 \times 37 \times 73}{6} = 6 \times 37 \times 73 = 16206, \text{ for the}$$

required number of shot in that pile.

Example III. Let the side of a square unfinished pile be 25, and the corner 18; then

$$\frac{25 \times 26 \times 51}{6} = 25 \times 13 \times 17 = 5525, \text{ by the}$$

first rule, for the content of the complete pile: now 18 taken from 25, leaves 7, and $\frac{7 \times 8 \times 15}{6}$

$= 7 \times 4 \times 5 = 140$ for the part wanting, which taken from 5525 leaves 5385 for the number required.

Table of oblong PILES of shot.

Rule III. From three times the length of the base more 1, subtract the breadth, multiply the remainder by the product of the breadth more 1, and divide by 6.

Example IV. Let the length *AE* of a complete oblong pile be 50, and the breadth 20; then 3 times 50 more 1, and 20 subtracted gives 131, and $\frac{131 \times 20 \times 21}{6} = 131 \times 10 \times 7 = 9170$, for the number required.

To find the content of the oblong PILE *ABDLE*, fig. 4.

Example V. Let the base *AE* = *a*, and the breadth = *z*; then will *CE* = *a* - *z*. This length, multiplied by $\frac{1}{2} z \times z + 1$, the triangular base *EDL*, gives $a - z \times \frac{1}{2} z \times z + 1$, for the prism *CBDLE*; to which add $\frac{1}{6} z \times z + 1 \times z z + 1$, the content of the square pyramid *ABC*, we get $a - z \times \frac{1}{2} z \times z + 1 + \frac{1}{6} z \times z + 1 \times z z + 1$, or $3a - z + 1 \times \frac{1}{6} z \times z + 1$, when reduced under the same denomination, for the content required.

Example VI. Let the length of an oblong unfinished pile be 25, its breadth 9, and corner row 6; then, by the 5th example, 3 times 25 more 1 and less 9, gives 67 and $\frac{67 \times 9 \times 10}{6} = 67 \times 3 \times 5 = 1005$, for the complete

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pile: now the corner row 6 taken from the side 25, and breadth 9, leaves 19 and 3; then 3 times 19 more 1, less 3, gives 55, and $\frac{55 \times 3 \times 4}{6} = 55 \times 1 \times 2 = 110$, for the part wanting; which, taken from 1005, leaves 895 for the required number.

PINTLE, in *artillery*, a long iron bolt, fixed upon the middle of the limber bolster, to go through the hole made in the trail-tranform of a field-carriage, when it is to be transported from one place to another. See **CARRIAGE**.

PINTLE-plate, is a flat iron, through which the pintle passes, and nailed to both sides of the bolster, with 8 diamond-headed nails.

PINTLE-washer, an iron ring through which the pintle passes, placed close to the bolster for the trail to move upon.

PINTLE-hole, is of an oval figure, made in the trail-tranform of a field-carriage, wider above than below, to leave room for the pintle to play in.

PINTLE-plates, one above and one below the pintle-hole, with a ring at the end, nailed to the trail-tranform, with diamond-headed nails.

PIN, an iron nail or bolt, with a round head, and generally with a hole at the end to receive a key: there are many sorts, as axle-tree pins, or bolts, bolster-pins, pole-pins, wing-tree pins, &c.

PIONEERS, in *war-time*, are such as are commanded in from the country, to march with an army, for mending the ways, for working on intrenchments and fortifications, and for making mines and approaches: the soldiers are likewise employed in all these things.

Most of the foreign regiments of artillery have half a company of pioneers, well instructed in that important branch of duty. Our regiments of infantry and cavalry have 3 or 4 pioneers each, provided with aprons, hatchets, saws, spades, and pick-axes.

PISTOL, the smallest piece of fire-arms, used by the cavalry, and borne on the saddle-bow.

To **PITCH tents**. See **TENTS**.

PLACARD, } or, as it is in the original
PLACART, } Dutch language, *Placaat*, a term used abroad for a proclamation, edict, &c. put up in all public places, by government authority; whereby their subjects are ordered to do, or forbear, something expressed therein.

PLACE, in *fortification*, signifies in general terms a fortified town, a fortress: hence we say it is a strong place.

PLACE

PLACE of arms in a town, a place left near its centre, where generally the grand guard is placed. In towns regularly fortified, the place of arms should be in the centre. In this place the soldiers of the garrison parade, form, and mount guard, &c.

PLACE of arms of an attack, or of a trench, are deep trenches 15 or 18 feet wide, joining the several attacks together: they serve to place the guard of the trenches in, to be at hand to support the workmen when attacked. It is customary to make 3 places of arms, when the ground will permit: the first, and most distant from the place, is about 300 toises from the glacis of the covert-way; the second is within 140 toises; and the third at the foot of the glacis. See PARALLELS.

PLACE of arms of a camp, is, strictly speaking, the bell-tents, at the head of each company, where the arms are lodged; likewise a place chosen at the head of the camp for the army to form in line of battle, for a review, or the like.

PLACE of arms of the covert-way, is a part of it, opposite to the re-entering angle of the counterscarp, projecting outwards in an angle.

PLAN, *ground plot*, or *ichnographia*, in fortification, is the representation of the first or fundamental tract of a work, showing the length of its lines, the quantity of its angles, the breadth of the ditches, thickness of the rampart and parapets, and the distance of one part from another: so that a plan represents a work, such as it would appear if cut equal with the level of the horizon, or cut off at the foundation: but it marks neither the heights nor depths of the several parts of the works: this is properly *profile*, which expresses only the heights, breadths, and depths, without taking notice of the lengths. As architects, before they lay the foundation of their edifice, make their design on paper, by which means they find out their faults; so an engineer, before tracing his works on the ground, should make *plans* of his designs upon paper, to the end he may do nothing without serious deliberation.

Exact plans are very useful for generals or governors, in either attacking or defending a place, in chusing a camp, determining attacks, conducting the approaches, or in examining the strength and weakness of a place; especially such plans as represent a place with the country about it, showing the rivers, fountains, marshes, ditches, valleys, mountains, woods, houses, churches, defiles, roads, and other particulars, which appertain to it.

PLANKS. See MADRIERS.

PLATES, or *prise-plates*, in artillery, two plates of iron on the cheeks of a gun-carriage, from the cope-square to the centre, through which the prise-bolts go, and on which the hand-spikes rest, when used in raising the breech of the gun, &c.

Breast-PLATES, the two plates on the face of the carriage, on the other cheek.

Train-PLATES, the two plates on the cheeks at the train of the carriage.

Dulidge-PLATES, the six plates on the wheel of a gun-carriage, where the fellies are joined together.

PLATFORM, in gunnery, is a bed of wood on a battery, upon which the guns stand; each consisting of 18 planks of oak or elm, a foot broad, 2½ inches thick, and from 8 to 15 feet long, nailed or pinned on 4, 5, or 6 beams, from 4 to 7 inches square, called sleepers. They must be made higher behind than before by 6 or 9 inches, to prevent too great a recoil, and to advance the gun easy when loaded. They are from 18 to 20 feet long, 8 feet before and 14 or 15 feet behind, and the direction left to the officers of the royal regiment of artillery.

PLATOON, in military affairs, a small body of men, in a battalion of foot, &c. that fire alternately. A battalion is generally divided into 16 platoons, exclusive of the grenadiers, which form 2 or 4 platoons more, as occasion may require.

PONIARD, a sort of short sword, used in Spain, Portugal, and Italy.

POINT-BLANK, of a gun, is the distance she throws a shot in a supposed direct line; the gun being laid at no elevation, but levelled parallel to the horizon. We say, supposed direct line, because it is certain, and easily proved, that a shot cannot fly any part of its range in a right line strictly taken; but the greater the velocity, the nearer it approaches to a right line; or the less crooked its range.

POINTING of a gun or mortar, is the placing either one or other, so as to hit the object, or to come as near it as possible.

POLE, in a 4-wheel carriage, is fastened to the middle of the hind axle-tree, and passes between the fore axle-tree and its bolster, fastened with the pole-pin, so as to move about it, and fastens the fore and hind carriages together.

POLYGON, is a figure of more than four sides, and is either regular or irregular, exterior or interior.

Regular POLYGON, is that whose angles and side are equal. It has an angle of the centre, and an angle of the polygon. The centre of a regular

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gular polygon, is the centre of a circle, which circumscribes the polygon; that is, whose circumference passes through all the angles of the figure.

Irregular POLYGON, is that whose sides and angles are unequal.

Exterior POLYGON, that whose lines touch the points of the flanked angles, when a place is fortified inwards.

Interior POLYGON, that outward fortification which makes the angles of the gorge; so that the whole bastion is without the polygon.

PONT de jonc, or *Pont volant*. See **BRIDGE**.

PONTOON, in *war*, a kind of flat-bottomed boat, whose carcase of wood is lined within and without with tin: they serve to lay bridges over rivers for the artillery and army to march over. The French pontoons, and those of most other powers, are made of copper on the outside: though they cost more at first, yet they last much longer than those of tin; and, when worn out, the copper sells nearly for as much as it cost at first; but when ours are rendered useless, they sell for nothing. Our pontoons are 21 feet long, 5 feet broad, and depth within 2 feet 1.5 inches.

Ponroon-carriage, is made with two wheels only, and two long side-pieces, whose fore ends are supported by a limber; and serves to carry the pontoon, boards, cross timbers, anchors, and every other thing necessary for making a bridge.

PONTOON-bridge, is made of pontoons, slipped into the water, and placed about 5 or 6 feet asunder; each fastened with an anchor, when the river has a strong current, or to a strong rope that goes across the river, running through the rings of the pontoons. Each boat has an anchor, cable, baulks, and chests. The baulks are about 5 or 6 inches square, and 21 feet long. The chests are boards joined together by wooden bars, about 3 feet broad, and 12 feet long. The baulks are laid across the pontoons at some distance from one another, and the chests upon them joined close; which makes a bridge, in a very short time, capable of supporting any weight.

POR1-cullice, in *fortification*, is an assemblage of several large pieces of wood, joined across one another like a harrow, and each pointed with iron at the bottom. They are sometimes hung over the gate-way of old fortified towns, ready to let down in case of a surprise, when the gates could not be shut.

PORT-fire, in *artillery*, a composition put in

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a paper case to fire guns and mortars, instead of a lint-stock and match. See **LABORATORY WORKS**.

POST, in *war*, any sort of ground, fortified or not, where a body of men can be in a condition of resisting the enemy.

Advanced Post, a spot of ground, seized by a party to secure their front, and the posts behind them.

Post of honour. The advanced guard is a post of honour: the right of the two lines is the post of honour, and is always given to the eldest regiment: the left is the next post, and is given to the next eldest, and so on. The centre of the lines is the post the last honourable, and is given to the youngest regiments. A sentinel placed before the colours, and at the door of the commanding officer, is a post of honour.

POSTERN, more frequently called a sally-port, is a small door in the flank of a bastion, or other part of a garrison, to march in and out unperceived by an enemy, either to relieve the works, or make sallies.

POUCH, in a *military sense*, is a square case or bag of leather, with a flap over it, pendent to a buff shoulder-belt, of about 3 inches broad, and hangs over the left shoulder of the infantry: its use is to hold cartridges, &c. They are made of the stoutest, blackened calf-skin, especially the outside flaps, which should be of such a substance, as to turn the severest rain. The cartridge-boxes in the inside of the pouches, to be made as light as possible, with 36 holes in each, in order to prevent the addition of boxes to buckle round the waist, which has often been productive of mischief and confusion, by blowing-up.

POUNDER, in *artillery*, is used to specify a certain caliber: thus a 24-pounder, a 12 or a 6-pounder, are those pieces whose balls weigh 24, 12, or 6 pounds.

POWDER. See **GUN-POWDER**.

POWDER-magazine, a bomb-proof arched building to hold the powder in fortified places, &c. containing several rows of barrels laid one over another. See **MAGAZINE**.

POWDER-cart, a two-wheel carriage, covered with an angular roof of boards; and, to prevent the powder from dampings, a tarred canvas is put over the roof: on each side are lockers to hold shot, in proportion to the quantity of powder, which is generally four barrels.

POWDER-mill, where the materials are beat,
C c mixed

mixed together, and grained: they are placed near rivers, and as far from any house as can be, for fear of accidents, which often happen. See MILL.

POZOLANA. See MORTAR.

PRACTICE, or *gun-practice*. In the spring, as soon as the weather permits, the exercise of the great guns begins, with an intention to show the gentlemen cadets at the royal military academy at Woolwich, and private men, the manner of laying, loading, pointing, and firing the guns. Sometimes instruments are used to find the centre line, or two points, one at the breech, the other at the muzzle, which are marked with chalk, and whereby the piece is directed to the target: then a quadrant is put into the mouth, to give the gun the required elevation, which at first is guessed at, according to the distance the target is from the piece. When the piece has been fired, it is sponged, to clear it from any dust or sparks of fire that might remain in the bore, and loaded: then the centre line is found, as before; and if the shot went too high, or too low, to the right or to the left, the elevation and trail are altered accordingly. This practice continues morning and evening for about six weeks, more or less, according as there are a greater or less number of recruits. In the mean time others are shown the motions of quick firing with field-pieces.

Mortar-PRACTICE, generally thus: a line of 1500 or 2000 yards is measured in an open spot of ground, from the place where the mortars stand, and a flag fixed at about 300 or 500 yards: this being done, the ground where the mortars are to be placed is prepared and levelled with sand, so that they may lie at an elevation of 45 degrees; then they are loaded with a small quantity of powder at first, which is increased afterwards, by an ounce every time, till they are loaded with a full charge: the times of the flights of the shells are observed, to determine the length of the fuzes. The intention of this practice is, when a mortar-battery is raised in a siege, to know what quantity of powder is required to throw the shells into the works at a given distance, and to cut the fuzes of a just length, that the shell may burst as soon as it touches the ground.

PRAME, in *military history*, a kind of floating battery, being a flat-bottomed vessel, which draws little water, mounts several guns, and is very useful in covering the disembarkation of troops. They are generally made use of in transporting the troops over the lakes in America.

PRIEST's-cap. See FORTIFICATION, and BONNET.

PRIMING, in *gunnery*, is the gun-powder put into the pan of small arms, and into the vent of cannon, that the powder may thereby be inflamed.

PRISONERS of war, those of the enemy who are taken in or after a battle, siege, &c.: they are deprived of their liberty at large, until exchanged.

PROFILE, in *fortification*, is the representation of a vertical section of a work, and serves to show those dimensions which cannot be represented in plans, but are yet necessary in the building of a fortification: they are best constructed on a scale of 30 feet to an inch. See Pl. XIV. fig. 1, 2, 3, 4, 5, &c.

PROOF of artillery and small arms, is a trial whether they will stand the quantity of powder allotted for that purpose. The rule of the board of ordnance is, that all guns, under 24-pounders, be loaded with powder as much as their shot weighs; that is, a brass 24-pounder with 21 lb. a brass 32-pounder with 26 lb. 12 oz. and a 42-pounder with 31 lb. 8 oz.; the iron 24-pounder with 18 lb. the 32-pounder with 21 lb. 8 oz. and the 42-pounder with 25 lb.

The brass light field-pieces are proved with powder that weighs half as much as their shot, except the 24-pounder, which is loaded with 10 lb. only.

Government allows 11 bullets of lead in the pound for the proof of muskets, and 14.5, or 29 in two pounds, for service; 17 in the pound for the proof of carabines, and 20 for service; 28 in the pound for the proof of pistols, and 34 for service.

When guns of a new metal, or of lighter construction, are proved, then, besides the common proof, they are fired 2 or 300 times, as quick as they can be, loaded with the common charge given in actual service. Our light 6-pounders were fired 300 times in 3 hours 27 minutes, loaded with 1 lb. 4 oz. without receiving any damage.

PROOF of powder, is in order to try its goodness and strength. There have been different inventions proposed and put in practice heretofore, for the proof of powder. See GUN-POWDER.

PROOF of cannon, is made to ascertain their being well cast, their having no cavities in their metal, and, in a word, their being fit to resist the effort of their charge of powder. In making this proof, the piece is laid upon the ground, supported only by a piece of wood in the middle, of about 5 or 6 inches thick, to raise the muzzle

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a little; and then the piece is fired against a solid butt of earth.

Tools to PROVE cannon are as follow:

Searcher, is an iron socket with branches, from 4 to 8 in number, bending outwards a little, with small points at their ends: to this socket is fixed a wooden handle, from 8 to 12 feet long, and $1\frac{1}{4}$ inch in diameter. This searcher is introduced into the gun after each firing, and turned gently round to discover the cavities within: if any are found, they are marked on the outside with chalk; and then the

Searcher with one point is introduced, about which point a mixture of wax and tallow is put, to take the impression of the holes; and if any are found of $\frac{1}{4}$ of an inch deep, or of any considerable length, the gun is rejected as unserviceable to the government.

Reliever, is an iron ring fixed to a handle, by means of a socket, so as to be at right angles: it serves to disengage the first searcher, when any

of its points are retained in a hole, and cannot otherwise be got out. When guns are rejected by the proof-masters, they order them to be marked X thus, which the contractors generally alter WP thus, and after such alteration, dispose of them to foreign powers for Woolwich proof.

The most curious instrument for finding the principal defects in pieces of artillery, was lately invented by lieutenant-general Delagulier, of the royal regiment of artillery. This instrument, grounded on the truest mechanical principles, is no sooner introduced into the hollow cylinder of the gun, than it discovers its defects, and more particularly that of the piece not being truly bored, which is a very important one, and to which most of the disasters happening to pieces of artillery, are in a great measure to be imputed; for, when a gun is not truly bored, the most expert artillereft will not be able to make a good shot. *See the following tables.*

Weight of powder for PROOF, service, and scaling brass and iron guns.

Pounders	Brass guns								
	Heavy			Medium			Light		
	Proof	Service	Scaling	Proof	Service	Scaling	Proof	Service	Scaling
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
42	31 8	21 0	3 4						
32	26 12	16 0	2 12						
24	21 0	12 0	2 0	18 0	9 0	2	10 0	5 0	2
18	18 0	9 0	1 8						
12	12 0	6 0	1 0	9 0	4 0	1	6 0	3 0	1
9	9 0	4 8	0 12						
6	6 0	3 0	0 8	6 0	$\frac{3}{2}$ or 0 8	8	3 0	1 8	8
4	4 0	2 0	0 6						
3	3 0	1 8	0 4	3 0	1 8	4	1 8	0 12	4
2	2 0	1 0	0 3						
$1\frac{1}{2}$	1 8	0 12	0 2						
1	1 0	0 8	0 $1\frac{1}{2}$						
$\frac{1}{2}$	0 8	0 4	0 1						

Pounders	Iron guns								
	Heavy			Medium			Light		
	Proof	Service	Scaling	Proof	Service	Scaling	Proof	Service	Scaling
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
42	25 0	17 0	3 4				22 3	14	3 4
32	21 8	14 0	2 12				19 1	10 10	2 12
24	18 0	11 0	2 0				16	8	2
18	15 0	9 0	1 8				13 5	6	1 8
12	12 0	6 0	1 0				10 10	4	1
9	9 0	4 8	0 12				8 8	3	12
6	6 0	3 0	0 8	4 0	2 0	8	5 5	2	8
4	4 0	2 0	0 6				3 8	1 10	6
3	3 0	1 8	0 4				2 10	1	4
2	2 0	1 0	0 3				1 12	10	3
1½	1 8	0 12	0 2				1 5	7	2
1	1 0	0 8	0 1½				14	4½	1½
½	0 8	0 4	1 1				7	2½	1

PROOF of mortars and howitzers, is made to ascertain their being well cast, and of strength to resist the effort of their charge. For this purpose the mortar or howitzer is placed upon the ground, with some part of their trunnions or breech sunk below the surface, and resting on wooden billets, at an elevation of about 70 degrees.

The mirror is generally the only instrument to discover the defects in mortars and howitzers. In order to use it, the sun must shine; the breech must be placed towards the sun, and the glass over-against the mouth of the piece: it illuminates the bore and chamber sufficiently to discover the flaws in it. See the following table.

Weight of powder for PROOF, scaling, and blowing of mortars, howitzers, royals, and coehorns, &c.

Nature	Proof	Scaling	blow- ing	Shells contain powder	Cham- ber contain powder	Shells weight
inches	lb. oz.	oz. dr.	oz. dr.	lb. oz. dr.	lb. oz.	lb.
13 S.	30 0	2 0 2	0 2 0	9 4 8	32 0	198
10 S.	10 4	1 0 1	0 4 0	4 14 12	12 8	93
13 L.	9 8	2 0 2	0 9 0	9 4 8	9 1	104
10 L.	3 14	1 0 1	0 4 0	4 14 12	4 0	90
8 L.	2 0	1 0 1	0 2 3	8 2 1	2 1	46
5½ R.	0 9	0 12 0	12 1 8	1 1 8	1 0	16
4½ C.	0 4½	0 8 0	8 0 8	0 8 0	0 8	9
10 H.	4 0	1 8 1	8 4 14	12 4 0	4 0	90
8 H.	3 8	1 0 1	0 2 3	8 2 0	2 0	46
5½ H.	1 0	0 12 0	12 1 8	1 1 8	1 0	16
4½ H.	0 8	0 8 0	8 0 8	0 8 0	0 8	9

N. B. S. stands for sea-mortar, L. for land-mortar, R. for royal, C. for coehorn, and H. for howitzer. The weight of the shells, and quantity of powder to fill them, differ sometimes considerably.

PROOF of small arms with leaden balls.

Nature of pieces	Balls for proof		Balls for service.		Wt. of powder in service
	N ^o . in 1 lb.	Wt. of each	N ^o . in 1 lb.	Wt. of each	
Wall-piece	6	oz. dr. 2 8	6 ²	oz. dr. 2 8	oz. dr. 0 12
Musket	11	1 7 ³ / ₁₁	14 ¹ / ₂	1 1 ¹ / ₂	0 6
Carbine	17	0 15 ¹ / ₁₇	20	0 12 ¹ / ₂	0 4 ¹ / ₂
Pistol	28	0 9 ¹ / ₂	34	0 7 ¹ / ₂	0 2 ¹ / ₂

N. B. In the proof of all sorts of small arms, the quantity of powder used is the weight of the ball exactly.

PROOF of foreign brass artillery.

1st. The *Prussians*. Their battering-train and garrison artillery are proved with a quantity of powder equal to $\frac{1}{2}$ the weight of the shot, and fired 75 rounds as fast as in real service; that is, 2 or 3 rounds in a minute.

Their light field-train, from a 12-pounder upwards, are proved with a quantity of powder = 1-3d of the weight of the shot, and fired 150 rounds, at 3 or 4 rounds in a minute. From a 12-pounder downwards, are proved with a quantity of powder = 1-5th of the shot's weight, and fired 300 rounds, at 5 or 6 rounds each minute, properly sponged and loaded.

Their mortars are proved with the chambers full of powder, and the shells loaded. Three rounds are fired as quick as possible.

2d. The *Dutch* prove all their artillery by firing each piece 5 times; the two first rounds with a quantity of powder = 2-3ds of the weight of the shot; and the three last rounds with a quantity of powder = $\frac{1}{2}$ the weight of the shot.

3d. The *French* the same as the Dutch.

4th. The *Portuguese* prove their artillery as follows, viz.

42 32 24	Pounders,	{ 1st shot 30lb. 1st shot 26lb. 1st shot 18lb. }	then diminishing 2lb. each round
12 6 3	Pounders,	{ 1st shot 10lb. 1st shot 5lb. 1st shot 2 ¹ / ₂ lb. }	dimin. 1lb. each round — $\frac{1}{2}$ lb. each round — $\frac{1}{4}$ lb. each round

They are only fired once in every minute.

Their mortars are proved by filling the chamber full of powder, a loaded shell, and the mortar rammed full of earth.

PROJECTILES, are such bodies as, being put in a violent motion by any great force, are then cast off, or let go from the place where they received their quantity of motion; as a shell or shot from a piece of artillery, a stone thrown from a sling, or an arrow from a bow, &c. This line is commonly taken for a parabola, and the ranges are computed from the properties of that curve. The assumption would be just, in case the ball, in its motion, met with no resistance: but, the resistance of the air to swift motions being very great, the curve described by the shot is neither a parabola, nor near it: and by reason of the resistance, the angle which gives the greatest amplitude is not 45 degrees, as commonly supposed, but something less, probably 43 $\frac{1}{2}$. Hence the sublime mathematics are absolutely necessary in the investigation of the track of a shell or shot in the air, known by the name of *military projectiles*.

Galileus having discovered that bodies projected in vacuo, and in an oblique direction to the horizon, do always describe a parabola; it was observable, that this doctrine was not sufficient to determine the real motion of a military projectile: for since shells and shot move with a great velocity, the resistance of the air becomes so great with respect to the weight of the projectile, that its effect turns the body very considerably from the parabolic tract; so that all calculations, grounded on the nature of this curve, are of little use on these occasions. This is not to be wondered at. since Galileus, in his enquiry, paid no regard to any other force acting on bodies, than the force of gravity only, without considering the resistance of the air.

Every body, moving in a fluid, suffers the action of two forces: the one is the force of gravity, or the weight of the body; and it is to be observed, that this weight is less than the natural weight of the body, that being diminished by an equal bulk of the fluid in which the body moves. The other force is that of the resistance, which is known to be proportional to the squares of the velocity of the body; and when the body is a globe, as is commonly supposed, the direction of this force is diametrically opposite to that of the motion of the body. This force changes continually, both in quantity and direction; but the first force remains constantly the same. Hence, the point in question is, to determine the curve which a body projected obliquely, must describe when acted upon by the two forces just now mentioned.

Although

Although this question is easily reduced to a problem purely analytical, the great Newton, notwithstanding his ingenious endeavours, did not arrive at a complete solution of it. He was the first who attempted it, and having succeeded so well in the supposition, that the resistance is proportional to the velocity, it is almost inconceivable that he did not succeed, when the resistance is supposed proportional to the squares of the velocity, after solving a number of questions incomparably more difficult. The late Mr. John Bernoulli gave the first solution of this problem, from which he drew a construction of the curve, by means of the quadratures of some transcendent curves, whose description is not very difficult.

This great problem was, therefore, very well solved long ago; yet the solution, however good in theory, is such as has hitherto been of no use in practice, nor in correcting the false theory grounded on the parabola, to which the artillery is still obliged to adhere, notwithstanding he knows it to be insufficient. It is certain, that that solution has been of no real advantage towards improving the art of gunnery: it has only served to convince the student in that art, of the error of his principles, drawn from the nature of the parabola, although he is still to abide by them. It is indeed something, to know that the common rules are erroneous; but unless we know how

much they err in any case, the advantage is very little.

One may think it a work of infinite labour to establish rules for the flight of cannon-shot, agreeable to the real curve which a body describes in the air: for although, according to the hypothesis of Galileus, we want only the elevation of the piece, and the initial velocity, and it is therefore not difficult to calculate tables to show the greatest height of the projectile, and the point where it must fall in any proposed case; yet in order to calculate similar tables according to the true hypothesis, care must be taken, besides the two particulars already mentioned, to have respect as well to the diameter of the projectile as to its weight: therefore the practitioner will be reduced to the necessity of calculating tables, as well for the diameter of each projectile, as for its weight; and the execution of such a work would be almost impracticable. We therefore refer the curious to Mr. Euler's *True Principles of Gunnery*, translated, with many necessary explanations and remarks, by the very learned and ingenious Hugh Brown, esq;.

That the reader may have a clear conception of the different conclusions deduced from this, and from the common theory, I shall here subjoin a table of the greatest range, and the ranges at 45 degrees by this theory; and also the ranges at 45 degrees by the common theory; the initial velocity being the same.

Comparison of the ranges by this theory, with those determined by the common theory, which supposes a vacuum, the initial velocity being given, &c.

Velocity per second in feet	For the greatest range by this theory															Range at 45° by this theory									
	12½-inch shell						9¼-inch shell						7¼-inch shell			12½-in shell	9¼-inch shell	7¼-inch shell	Range at 45° in vacuo						
	Limits of elevation between			Range in feet some- thing more than			Limits of elevation between			Range in feet some- thing more than			Limits of elevation between							Range in feet some- thing more than					
0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	Feet							
600	40	0	15	43	12	33	6748.040	39	33	5	41	6	53	6098.36	39	4	9	41	6	53	5646.94	6680.505	6061.32	5582.62	11191.7
900	39	4	9	40	32	28	10631.57	36	37	1	38	0	26	9446.72	35	5	21	36	27	33	8405.97	10370.06	9218.50	8206.39	25181.3
1200	34	27	40	36	27	33	13928.49	33	44	52	35	38	12	12301.48	33	44	52	35	2	58	10531.91	13442.88	11530.65	9987.27	44766.8
1500	33	44	52	35	2	58	16558.45	33	16	6	34	33	33	14085.96	32	27	50	34	33	35	12203.43	15629.30	13494.96	11695.36	69948.2
1800	32	27	50	34	33	35	18762.77	30	48	50	32	51	59	15854.64	30	48	50	31	54	56	13685.55	18114.09	14712.06	12403.80	100725.4
2200	30	48	50	32	51	39	20706.91	30	48	50	31	54	56	17816.56	29	53	5	31	4	15	14847.49	19337.07	16012.82	13782.98	137098.4
2400	30	48	50	31	54	50	22124.69	29	0	9	31	4	15	18468.58	29	0	9	31	4	15	16026.99	20613.40	17139.99	14436.90	199067.3
2700	29	29	53	31	4	15	23604.66	29	0	9	31	4	15	19787.96							21889.72	18018.94			226632.2

Experiments intended to try the ranges computed by this theory, with those determined by the common theory, at Gibraltar, in 1766, communicated to me by Capt. Jardine.

10-inch howitzer					
Weight 30 C. Length of chase 28½ in. Diam. chamber 6.65			Weight shell 90 lb. Length chamb. 16½ in. Windage .3 inches.		
Elevation	Powder	Ranges real	Me- diums	Should be by the new theory.	Should be by the pa- rabola.
°	lb. oz.	yards	yards	yards	yards
45	2	967	968½	916	1028
	2	970			
	1 12	816	830	772	880
		826			
		845			
9	1 8	836	660	600	640
		670			
		718			
		637			
		662			
12	2	318	314	330	294
		324			
		302			
		270			
		250			
9	1 12	292	270	290	250
		271			
		259			
		251			
		263			
12	1 8	271	260	285	254
		259			
		251			
		263			
		271			

.8-inch howitzer					
Wt. howitzer 11½ C. Length chase 25½ in. Diam. chamb. 4.8 in.			Weight of shell 48 lb. Length chamb. 9½ in. Windage .3 inches.		
Elevation	Powder	Ranges real	Me- diums	Should be by the new theory	Should be by the pa- rabola.
°	lb. oz.	yards	yards	yards	yards
45	1	1000	985	941	1102
		935			
	14	1020	837	800	920
		794			
		880			
9	12	718	683	635	690
		670			
		672			
		662			
		695			
12	1	685	340	356	300
		361			
		356			
		307			
		287			
9	14	297	283	290	256
		265			
		274			
		300			
		280			
12	12	276	280	248	276
		276			
		276			
		276			
		276			

In these experiments, from the ranges at 45 degrees elevation, it was calculated what those at 9° and 12° should be; and from those lower elevations, what the higher should be: first by Mr. Robins's theory in column fifth, then by the usual way, supposing the curve a parabola, in the last column.

It must be confessed that these experiments are not so decisive as could be wished, for want of time, and of a sufficient range, &c. to give a fair trial to Mr. Robins's principles; for, as the ranges increase, the errors of the parabolic theory would likewise increase; which, in Mr. Robins's method, probably is not the case:

but a more simple and less tedious manner of applying it to practice is still wanting; which perhaps might be done by the help of more tables, &c.

Military PROJECTILE demonstrated. Let (fig. 1. Pl. XIII.) *CNAMH* be the curve described by a globe in any fluid; and let *a* denote the accelerate force of gravity, and let *c* be the retardive force of the resistance. Let *A* be the highest point of the curve, and the horizontal line *BAE* a tangent in that point. *CAN* will be a portion in that curve, by which the globe ascends, and *AMH* that by which it descends. Let us consider separately the motion in the ascent and descent; and for the descent, let any abscissa taken on the horizontal line *AP* = *x*, and

and the corresponding vertical ordinate $PM=y$; and let v denote the distance a body must fall freely to acquire the velocity of the globe at M , and the retardive force of resistance at M will be $=\frac{v}{c}$.

Resolving the motion of the body into the horizontal direction AP , and the vertical direction PM , this will be accelerated by the accelerative force of gravity a . The retardive force of the resistance $\frac{v}{c}$ acting in the direction of the tangent MT , if we put the fluxion of the curve $Mm=S$, there will result a force which opposes the horizontal motion $=\frac{v \dot{x}}{c \dot{S}}$. Therefore, if the fluxion of the time be denoted

by \dot{t} , so $\dot{t} = \frac{\dot{S}}{\sqrt{v}}$, and \dot{t} be supposed constant,

the mechanical principles of acceleration furnish these two equations: $\frac{2 \ddot{x}}{\dot{t}^2} = -\frac{v \ddot{x}}{c \dot{S}}$; and

$$\frac{2 \ddot{y}}{\dot{t}^2} = a - \frac{v \dot{y}}{c \dot{S}}.$$

Since $\dot{t} = \frac{\dot{S}}{\sqrt{v}}$, we have $v = \frac{\dot{S}^2}{\dot{t}^2}$, whence

the foregoing equations become: $\frac{2 \ddot{x}}{\dot{t}^2} = -\frac{\dot{x} \dot{S}}{c \dot{t}^2}$,

and $\frac{2 \ddot{y}}{\dot{t}^2} = a - \frac{\dot{y} \dot{S}}{c \dot{t}^2}$. Suppose $\dot{y} = p \dot{x}$, so

that p denote the tangent of the angle PTM , or of the inclination of the globe's motion to the horizon; then because $\dot{S} = \dot{x} \sqrt{1+p^2}$, and $\dot{y} = p \dot{x} + \dot{x} \dot{p}$, we shall have these two

equations: $\frac{2 \ddot{x}}{\dot{t}^2} = -\frac{\dot{x}^2 \sqrt{1+p^2}}{c \dot{t}^2}$, and $\frac{2 p \ddot{x}}{\dot{t}^2} + \frac{2 \dot{x} \dot{p}}{\dot{t}^2} = a - \frac{p \dot{x}^2 \sqrt{1+p^2}}{c \dot{t}^2}$; and the first multi-

plied by p , and taken from the last, leaves $\frac{2 \dot{x} \dot{p}}{\dot{t}^2} = a$, or $a \dot{t}^2 = 2 \dot{x} \dot{p}$; and since the first

gives $\frac{2 \ddot{x}}{\dot{t}^2} = -\frac{\sqrt{1+p^2}}{c}$, we find $v = \frac{\dot{x}^2 \sqrt{1+p^2}}{\dot{t}^2}$

$$a \dot{x} \times 1 p^2$$

Because $2 \dot{p} = \frac{a \dot{t}^2}{\dot{x}}$; the other equation —

$\frac{2 \ddot{x}}{\dot{t}^2} = -\frac{\sqrt{1+p^2}}{c}$, multiplied by \dot{p} , is reduced to

$-\frac{2 a \dot{t}^2 \ddot{x}}{\dot{x}^3} = \frac{2 \dot{p} \sqrt{1+p^2}}{c}$, whose fluent, \dot{t} being

constant, is $\frac{a \dot{t}^2}{\dot{x}^2} = \frac{2 \dot{p}}{\dot{x}} = 2 C + \frac{2}{c}$ into the

fluent of $\dot{p} \sqrt{1+p^2}$; from which we deduce

$\dot{x} = \frac{\dot{t}}{C + \frac{1}{c} \times \text{fluent of } \dot{p} \sqrt{1+p^2}}$ and $\dot{y} = \frac{p \dot{p}}{C + \frac{1}{c} \times \text{fluent of } \dot{p}}$

—; therefore $\dot{S} = \dot{x} \sqrt{1+p^2} = \frac{\dot{t} \sqrt{1+p^2}}{C + \frac{1}{c}}$

$\frac{\dot{p} \sqrt{1+p^2}}{C + \frac{1}{c}}$. Finally, because $a \dot{t}^2 = 2 \dot{x} \dot{p}$,

we shall have $\frac{1}{2} a \dot{t}^2 = \frac{\dot{p}^2}{C + \frac{1}{c} \times \text{fluent of } \dot{p} \sqrt{1+p^2}}$, and

$\dot{t} \sqrt{\frac{1}{2} a} = \frac{\dot{p}}{\sqrt{C + \frac{1}{c} \times \text{fluent of } \dot{p} \sqrt{1+p^2}}}$, and, finally,

for the velocity $v = \frac{\frac{1}{2} a \times 1 + p^2}{C + \frac{1}{c} \times \text{fluent of } \dot{p} \sqrt{1+p^2}}$.

It is evident, that the expressive fluent of $\dot{p} \sqrt{1+p^2}$ in the foregoing equations, expresses a parabolic arc; or it may be assigned by logarithms, since the fluent of $\dot{p} \sqrt{1+p^2} = \frac{1}{2} p \sqrt{1+p^2} + \frac{1}{2} \log. p + \sqrt{1+p^2}$; taking the fluent so that it may vanish when $p=0$, which is the case at the vertex of the curve, where the tangent is horizontal: therefore, supposing the angle of the inclination of the body's motion to the horizon, whose tangent is $=p$, to be known at the point M , we find the abscissa $AP = x$, the ordinate $PM = y$, the arc $AM = s$, the height answering to the velocity at M , and finally the time of describing the arc AM .

Put the quantity C , which is introduced into the fluent, equal to the fraction $\frac{n}{c}$, it is manifest, that n denotes an abstract number. Let, for brevity sake, the fluent of $\dot{p} \sqrt{1+p^2} = P$. Since the value of P is easily found for every value of p , we shall have the following equations for the branch AMH , by which the body descends:

P R O

descends: $x = c \times \text{fluent of } \frac{\dot{p}}{n+P}$; $y = c \times$

fluent of $\frac{p\dot{p}}{n+P}$, $S = c \times \text{fluent of } \frac{\dot{p}\sqrt{1+p^2}}{n+P}$;

$t\sqrt{\frac{1}{2}a} = \frac{\dot{p}\sqrt{c}}{\sqrt{n+P}}$, or $t = \frac{\sqrt{2c}}{\sqrt{a}} \times \text{fluent of}$

$\frac{\frac{1}{2}ac \times \sqrt{1+p^2}}{n+P}$. These fluents

are to be taken so, that they may vanish in the case where $p = 0$; whence it appears that the height answering to the velocity at A will be $\frac{ac}{2n}$.

The same equations serve to express the nature of the other branch ANC , which the body describes in its ascent, by taking the value of P negative: therefore, if the direction of the motion at N make, with the horizontal line, an angle whose tangent is p , we shall have $AQ =$

$c \times \text{fluent of } \frac{\dot{p}}{n-P}$; $QN = c \times \text{fluent of } \frac{p\dot{p}}{n-P}$

$AN = c \times \text{fluent of } \frac{p\sqrt{1+p^2}}{n-P}$; and the time of

describing the arc $AN = \frac{\sqrt{2c}}{\sqrt{a}} \times \text{fluent of}$

$\frac{\frac{1}{2}ac \times \sqrt{1+p^2}}{n-P}$, and the height answering to the velo-

city at $N = \frac{\frac{1}{2}ac \times \sqrt{1+p^2}}{n-P}$. Whence it is evident,

that in the ascending branch ANC , the inclination of the tangent to the horizon can no where become so great, that P shall be greater than n , and that when $P = n$ the velocity of the body is infinite.

The velocity of the body, and $CNAMH$ which it describes, depend on three constant quantities, a , c , and n ; whose values must be found for every case proposed. The first, a , is determined from the relation of the specific gravity of the fluid to that of the globe; and since it does not come into the expressions which determine the nature of the curve, that will be known independent of a : it is only the time and velocity which depend upon it. The quantity c is found by means of the diameter and weight of the globe; and, as it is used only as a multiplier, it causes no difficulty in the cal-

P R O

culution. But the third quantity n , which depends on the velocity, affects our expressions in such a manner, that they must be calculated separately for all the different values of n .

In order to unfold more fully the nature of this curve, it is necessary to consider the radius or curvature, which measures its curvature at any point. Now, if $y = \dot{p}x$, the radius of curvature is known to be $\frac{\dot{x} \times \sqrt{1+p^2} \times \sqrt{1+p^2}}{\dot{x} \times \sqrt{1+p^2} \times \sqrt{1+p^2}}$.

Therefore, since $\frac{\dot{x}}{\dot{p}} = \frac{c}{n+P}$ for the descending branch, the radius of curvature at M will be $= \frac{c \times \sqrt{1+p^2} \times \sqrt{1+p^2}}{n+P}$. And for the ascending branch,

where y is also $= \dot{p}x$, the radius of curvature at N will be $= \frac{c \times \sqrt{1+p^2} \times \sqrt{1+p^2}}{n-P}$. Therefore,

when $P = n$, and the velocity of the body infinitely great, the radius of curvature becomes infinitely great also; and it appears, that in these two branches, where the tangents are equally inclined to the horizon, the radius of curvature, and also the other quantities x , y , s , t , and v , are greater in the ascending than in the descending branch.

Therefore, in a resisting medium, the two branches of the curve are dissimilar, so that the curvature is greatest in the descending branch, and the motion swiftest in the ascending branch. But when there is no resistance, it is known that the two branches are equal and similar, and also the motion the same in both; for, in vacuo, the quantity c becomes infinite, and so does the number n , since $\frac{ac}{2n}$ denotes the height answering to the velocity at A . Therefore P will be nothing in respect of n ; and because $a = 1$, if we put $\frac{c}{2n} = b$; we shall have for a non-resisting medium $x = 2bp$, $y = p^2$, $s = 2b \times \text{fluent of } \frac{p}{\sqrt{1+p^2}}$; $t = 2bp$; $v = b \times \sqrt{1+p^2}$; and the radius of the curvature $= 2b \times \sqrt{1+p^2}$. Whence it is evident, that the curve is a parabola, and the motion such as it is generally allowed to be.

It is, therefore, from the quantity $P =$ the fluent of $\frac{p}{\sqrt{1+p^2}}$, that the difference arises between a trajectory in vacuo, and in a fluid; and, it is evident, that this difference will be so much

much greater, the greater P is in respect to n . Now the quantity P vanishes at the vertex A ; and from thence, P increases as the angle $MT P$, which the tangent of the curve makes with the horizon, increases; so that when this becomes a right angle, the quantity P becomes infinite; consequently, how small soever the resistance be, the curve $CNAMH$ will at length deviate infinitely from a parabola; since, by continuing its branches, it must necessarily happen that the quantity P shall not only become equal to the number n , but at last infinitely exceed it.

PROVISIONS, in a *military sense*, implies all manner of eatables, food, or provender, used in an army, both for man and beast.

PROVOST-Marshal, of an army, is an officer appointed to secure deserters, and all other

criminals: he is often to go round the army, hinder the soldiers from pillaging, indict offenders, execute the sentence pronounced, and regulate the weights and measures used in the army when in the field. He is attended by a lieutenant's guard, has a clerk, and an executioner.

PUNISHMENT, in the *army*, in general, signifies the execution of a sentence pronounced by a court-martial upon any delinquent; but in particular it means that kind of punishment often used by inflicting a certain number of lashes upon a non-commissioned officer, or private man.

PULLY, in *military mechanics*. See **MECHANICS**.

Q

QUADRANT, in *gunnery*, an instrument made of brass or wood, divided into degrees, and each degree into 10 parts, to lay guns or mortars to any angle of elevation.

The common sort is that whose radii projects the quadrant about 12 inches, and a plummet suspends in its centre, by means of a fine thread of silk; so that, when the long end is introduced into the piece, the plummet shows its elevation.

The best sort has a spiral level fixed to a brass radius; so that, when the long end is introduced into the piece, this radius is turned about its centre till it is level; then its end shows the angle of elevation, or the inclination from the horizon; whereas the first shows that angle from the vertical. See **LEVEL**.

QUADRAT, or *to quadrat a gun*, is to see it duly placed in its carriage, and that the wheels be of an equal height.

QUARTER, in *war*, signifies the sparing of men's lives, and giving good treatment to a vanquished enemy. Hence, *to give quarter*, *to take quarter*, &c.

QUARTERS, at a *siege*, the encampment upon one of the most principal passages round a place besieged, to prevent relief and convoys.

Head QUARTERS, of an army, the place where the commander in chief has his quarters. The quarters of generals of horse are, if possible, in villages behind the right and left wings; and the generals of foot are often in the same place:

but the commander in chief should be near the centre of the army.

QUARTERS of refreshment, the place or places where troops that have been much harrassed are put to recover themselves, during some part of the campaign.

QUARTER of an assembly, the place where the troops meet to march from in a body, and is the same as the place of rendezvous.

Intrenched QUARTERS, a place fortified with a ditch and parapet to secure a body of troops.

Winter QUARTERS, sometimes means the space of time included between leaving the camp and taking the field; but more properly, the places where the troops are quartered during the winter.

The first business, after the army is in *winter-quarters*, is to form the chain of troops to cover the quarters well: which is done either behind a river, under cover of a range of strong posts, or under the protection of fortified towns. Hussars are very useful on this service.

It should be observed, as an invariable maxim, in *winter-quarters*, that your regiments be disposed in brigades, to be always under the eye of a general officer; and, if possible, let the regiments be so distributed, as to be each under the command of its own chief.

QUARTER-master, is an officer, generally a lieutenant, whose principal business is to look after the quarters of the soldiers, their cloathing, bread, ammunition, firing, &c. Every regiment

of foot, and artillery, has a quarter-master, and every troop of horse one, who are only warrant-officers, except in the Blues.

QUARTER-master-general, is a considerable officer in the army, and should be a man of great judgement and experience, and well skilled in geography: his duty is to mark the marches, and encampments of an army: he should know the country perfectly well, with its rivers, plains, marshes, woods, mountains, defiles, passages, &c. even to the smallest brook. Prior to a march he receives the orders and route from the commanding general, and appoints a place for the quarter-masters of the army to meet him next morning, with whom he marches to the next camp, where being come, and having viewed the ground, he marks out to the regimental quarter-masters the ground allowed each regiment for their camp: he chuses the head quarters, and appoints the villages for the generals of the army's quarters: he appoints a proper place for the encampment of the train of artillery: he conducts foraging parties, as likewise the troops to cover them against assaults, and has a share in regulating the winter quarters and cantonments.

QUARTER-wheeling of a platoon, &c. is turning the front where the flank was; which is done to the right, by the man on the right wing keeping his ground, and facing about while the left wing wheels. See **WHEELING**.

QUARTER-staff, an old military weapon, is made of strong and even wood, bigger and heavier than a pike: it is $6\frac{1}{2}$ feet long between the verrils, that keep fast the two pikes of iron stuck into the ends of the staff.

QUARTER, in the *manage*, as to work from quarter to quarter, is to ride a horse three times in upon the first of the four lines of a square; then, changing your hand, to ride him three times upon the second; and so to the third and fourth; always changing hands, and observing the same order.

QUARTERING troops, is to provide them with good quarters.

QUEUE D'ARONDE, in *fortification*, an outwork which is narrower at the gorge than at the front or face, being so called from its resembling a swallow's tail. Of this kind are some single or double tenailles, and even some horn-works whose sides are not parallel. See **SWALLOW'S TAIL**, and **FORTIFICATION**.

QUICK-match, in *laboratory works*. See **LABORATORY**.

QUILTING grape-shot, in *gunnery*. See **LABORATORY**, and *To make GRAPE-SHOT*.

QUINTAL, the same as hundred weight.

QUOIL, in *gunnery*, denotes when a rope is laid round in a ring, one turn over another, for its being transported, or laid away.

QUOINS, in *gunnery*. See **COINS**.

R

RABINET, in *gunnery*, formerly a name given to a small sort of ordnance between a falconet and a base, about $1\frac{1}{2}$ inches diameter in the bore, 5 feet 6 inches long, and 300 pounds in weight, loaded with 6 ounces of powder, carries a shot $1\frac{1}{2}$ inches diameter. See **CANNON**.

RAFTERS, in *military buildings*, are pieces of timber, which, standing by pairs on the reason or raising-piece, meet in an angle at the top, and form the roof of a building.

It is a rule in building, that no rafters should stand farther than 12 inches from one another: and as to their sizes or scantlings, it is provided by act of parliament, that principal rafters, from 12 feet 6 inches to 14 feet 6 inches long, be 5 inches broad at the top, and 8 at the

bottom, and 6 inches thick: those from 14 feet 6 inches, to 18 feet 6 inches long, to be 9 inches broad at the foot, 7 inches at the top, and 7 inches thick: and those from 18 feet 6 inches, to 21 feet 6 inches, to be 10 inches broad at the foot, 8 at the top, and 8 thick. Single rafters, 8 feet in length, must have $4\frac{1}{2}$ inches, and $3\frac{1}{2}$ in their square. Those of 9 feet long, must be 5, and 4 inches square.

RAFTS, in a *military sense*, a kind of frames or floats made by laying pieces of timber together, or across each other, to serve as bridges for troops to pass over rivers.

To RAISE a { *siege*. See **SIEGE**.
plan of a fortress, is the measuring, with cords and geometrical instruments, the length of the lines, and the capacity of the angles,

angles, that by knowing the length, breadth, and thickness, of all the different parts of a fortification, it may be represented in small upon paper, so as to know the advantages and disadvantages of it.

RALLYING, in *war*, re-establishing, or forming together again, troops broken and put to flight.

Battering-RAM, in *antiquity*, a military engine used to batter and beat down the walls of places besieged.

The battering-ram was of two sorts, the one rude and plain, the other compound. The former seems to have been no more than a great beam, which the soldiers bore on their arms and shoulders, and with one end of it, by main force, assailed the walls. The compound ram is thus described by Josephus: it is a vast beam, like the mast of a ship, strengthened at one end with a head of iron, something resembling that of a ram, whence it took its name. This was hung by the middle with ropes to another beam, which lay across two posts, and hanging thus equally balanced, it was by a great number of men drawn backwards and pushed forwards, striking the wall with its iron head.

Plutarch informs us, that Mark Anthony, in the Parthian war, made use of a ram 80 feet long: and Vitruvius tells us, that they were sometimes 106, and sometimes 120 feet long; and to this perhaps the force and strength of the engine was in a great measure owing. The ram at one time was managed by a whole century of soldiers; and they, being spent, were seconded by another century; so that it played continually, without any intermission.

The momentum of a battering-ram 28 inches in diameter, 180 feet long, with a head of cast-iron of one tun and a half, the whole ram, with its iron hoops, &c. weighing 41,112 pounds, and moving by the united strength of 1000 men, will be only equal to that of a ball of 36 pounds, when shot point-blank from a cannon.

RAMMER, an instrument used for driving down stones or piles into the ground in military works; or for beating the earth, in order to render it more solid for a foundation.

RAMMER of a gun, the ram-rod or gun-stick; a rod used in charging of a gun, to drive home the powder, as also the shot, and the wad, which keeps the shot from rolling out. The rammer of a piece of artillery, is a cylinder of wood, whose diameter and length are each equal to the diameter of the shot, with a handle fixed

to it, at the end of which is another cylinder, covered with lamb-skin, so as to fit the gun exactly, and called a sponge: it is used to clean the piece before and after it is fired.

RAMPART, in *fortification*, or, as some call it, but improperly, *rampire*; the great massy bank of earth raised about a place to resist the enemy's great shot, and to cover the buildings. On it is raised a parapet towards the campain. It is not above 18 feet high, and about 60 or 70 thick, unless more earth be taken out of the ditch than can be otherwise bestowed. The rampart should be sloped on both sides, and be broad enough to allow the marching of waggons and cannon, besides the parapet which is raised on it. The rampart of the half-moons is better for being low, that the small-arms of the besieged may the better reach the bottom of the ditch; but it must be so high, as not to be commanded by the covert-way. The rampart is encompassed with a ditch, and is sometimes lined with a fausse-bray and a berme. During a siege, soldiers are always posted on the rampart, and sometimes artillery to strengthen the defence.

RAMPS, in *fortification*, are sloping communications, or ways of very gentle ascent, leading from the inward area, or lower part of a work, to the rampart or higher part of it.

RAMS-borns, in *fortification*, are a kind of low works made in the ditch of a circular arc; they were invented by M. Belidor, and serve instead of tenailles.

RANDOM-shot, in *artillery*, when the piece is elevated at an angle of 45 degrees upon a level plane. See **RANGE**.

RANGE, in *gunnery*, the distance from the battery to the point where the shot or shell touches the ground.

Point-blank RANGE, that when the piece lies in a horizontal direction, and upon a level plane, without any elevation. See **POINT-BLANK**.

RANGING, in *war*, disposing the troops in order proper for an engagement, for manœuvring, or for marching, &c.

RANK, is a straight line made by the soldiers of a battalion, or squadron, drawn up side by side: this order was established for the marches, and for regulating the different bodies of troops and officers which compose an army.

RANK, and precedence in the army and navy, as follows:

Engineers RANK. Chief, as colonel; director,

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as lieutenant-colonel ; sub-director, as major ; engineer in ordinary, as captain ; engineer extraordinary, as captain-lieutenant ; sub-engineer, as lieutenant ; practitioner-engineer, as ensign.

Navy RANK. Admiral, or commander in chief of his Majesty's fleet, has the rank of a field-marshal ; admirals, with their flags on the main-top-mast-head, rank with generals of

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horse and foot ; vice-admirals, with lieutenant-generals ; rear-admirals, as major-generals ; commodores, with broad pendants, as brigadier-generals ; captains of post-ships, after three years from the date of their first commission, as colonel ; other captains, as commanding post-ships, as lieutenant-colonels ; captains, not taking post, as majors ; lieutenants, as captains.

RANK *between the army, navy, and governors.*

ARMY	NAVY	GOVERNORS
General in chief	Admiral in chief	Commander in chief of the forces in America
Generals of horse	Admiral with a flag at the main-top-mast	Captain-general of provinces
Lieutenant-generals	Vice-admirals	Lieutenant-generals of provinces
Major-generals	Rear-admirals	Lieutenant-governors and presidents
Colonels	Post-captains of 3 years	Lieutenant-governors not commanding
Lieutenant-colonels	Post-captains	Governors of charter colonies
Majors	Captains	Deputy governors
Captains	Lieutenants	Established by the king, 1760

Doubling of the RANKS, is the placing two ranks in one, frequently used in the manœuvres of a regiment.

RANKS and files, are the horizontal and vertical lines of soldiers when drawn up for service, &c.

RANSOM, in *military history*, a sum of money paid for the liberty of a prisoner of war ; it also means the exchange of prisoners of war.

RAPIER, formerly signified a long, old-fashioned broad-sword, such as those worn by the Scotch regiments ; but now is understood only to mean a small sword, as contradistinguished from a back-sword.

RASANT, } in *fortification*, rasant flank, or

RAZANT, } line, is that part of the curtain or flank whence the shot exploded rase or glance along the surface of the opposite bastion.

RATION, in the *army*, a day's allowance of bread, or of forage, given to every man and horse. A ration of bread is 1½ pound each day ; and for a horse 20lb. of hay, 10lb. of oats, and 5lb. of straw, and for want of straw, 25lb. of hay. The officers have several rations, according to their rank. In the last German war, especially towards the latter end of it, a

ration for a horse was only 18lb. of hay, 6lb. of oats, and 5lb. of straw.

It is to be observed, that the troops in North-America are daily supplied with ships provisions (independent of their pay) from his majesty's stores : a soldier's allowance per week is 7lb. of beef, or in lieu thereof 4lb. of pork ; 7lb. of biscuit bread, or the same weight of flour ; 6 oz. of butter ; 3 pints of pease ; ½lb. of rice : and this is called 7 rations. Of these rations a general had 12, colonel 6, lieutenant-colonel 5, major 4, captain 3, subaltern 2, staff 2, chief engineer 5, engineer in ordinary 3, practitioner engineer 2, director of the hospital 5, head surgeon 3, surgeon's mate 1, head apothecary 3, his mate 1, commissary of stores 3, his clerk 2.

RAVELINS, in *fortification*, are works raised on the counterscarp before the curtain of the place, and serve to cover the gates of a town, and the bridges. They consist of two faces, forming a salient angle, and are defended by the faces of the neighbouring bastions. They are the most in use of all out-works, and are by the soldiers most commonly called half-moons. They should be lower than the works of the place, that they may be under the fire of

of the besieged. Their parapets, as those of all out-works, should be cannon-proof; that is, about 18 feet thick.

RAVINE, in *field fortification*, a deep hollow, usually formed by a great flood, or long-continued running of water; frequently turned to good purposes in the field.

REAR of an army, signifies, in general, the hindermost part of an army, battalion, regiment, or squadron; also the ground behind either.

REAR-guard, is that body of an army which marches after the main-body; for the march of an army is always composed of an advance-guard, a main-body, and a rear-guard; the first and last commanded by a general. The old grand-guards of the camp, always form the rear-guard of the army, and are to see that every thing come safe to the new camp. See **GUARD**.

REAR-half-files, are the three hindmost ranks of the battalion, when it is drawn up six deep.

REAR-line, of an army encamped, is always 1200 feet at least from the centre line; both of which run parallel to the front line, as also to the reserve.

REAR-rank, is the last rank of a battalion, when drawn up, and generally 16 or 18 feet from the centre-line, when drawn up in open order.

REBELLION, a traitorous taking-up of arms against the king by his own natural subjects, or those formerly subdued.

RECOIL, in *gunnery*, is the running-back of the artillery when fired; which is occasioned by the struggling of the powder in the chamber, and its seeking every way to fly out. Guns, whose vents are a little forward in the chase, recoil most. To lessen the recoil of a gun the platforms are generally made sloping towards the embrasures of the battery.

RECONNOITRE, in *military affairs*, implies to view and examine the state of things, in order to make a report thereof.

Parties ordered to reconnoitre, are to observe the country and the enemy; to remark the routes, conveniences and inconveniences of the first; the position, march, or forces of the second. In either case, they should have an expert geographer, capable of taking plans readily: he should be the best mounted of the whole, in case the enemy happen to scatter the escorte, that he may save his works and ideas.

All parties that go for reconnoitring only, should be but few in number. I would never chuse more than twelve or twenty men. An

officer, be his rank what it will, cannot decline going with so few under his command: the honour is amply made up by the importance of the expedition, frequently of the most interesting consequence, and the properest to recommend the prudence, bravery, and address of any officer that has the fortune to succeed.

It is previously necessary that the officer ordered on this duty should be well acquainted with the country, the roads, and the distance of the enemy. His party must consist of men of approved fidelity, part of whom should be disguised. This detachment must march off in the night. The men must have strict orders neither to smoke tobacco, make a noise, nor speak. The officer must be provided with two guides, who are to be strictly interrogated, but are to remain ignorant of the route you intend to take. A detachment of this kind should be furnished with subsistence for 2 or 3 days. The horses are to be fed every 2 or 3 leagues, for it is absolutely necessary that they should be always fresh and fit for duty. The officer will take care never to halt, but at a distance from any road, and also take every precaution to prevent his being surprised, whilst his horses are feeding, &c.

RECRUITS, in *military affairs*, are new men raised to supply the places of such as have lost their lives in the service.

RECRUIT-horses, are the horses brought up for completing the regiments of horse and dragoons.

RECTANGLE. See **ANGLE**.

REDANS, in *field fortification*, are a kind of indented works, lines, or faces, forming sallying and re-entering angles, flanking one another; generally used on the sides of a river which runs through a garrison-town. They were used before bastions were invented, and are by some thought preferable to them.

REDENS, } See **REDANS**.
REDENT, }

REDOUT, in *fortification*, a square work of stone, raised without the glacis of the place, about musket-shot from the town; having loop-holes for the small arms to fire through, and surrounded by a ditch. Sometimes they are of earth, having only a defence in front, surrounded by a parapet and ditch. Both the one and the other serve for detached guards to interrupt the enemy's works; and are sometimes made on the angles of the trenches for covering the workmen against the sallies of the garrison. The length of their sides may be about

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about 12 or 20 toises: their parapets must have 2 or 3 banquettes, and be about 9 or 10 feet thick. They are sometimes (in a siege) called places of arms.

REDOUT, is also the name of a small work made in a ravelin, of various forms. See **FORTIFICATION**.

REDOUT, *castle or donjon*, a place more particularly intrenched, and separated from the rest by a ditch. There is generally in each of them a high tower, from whence the country round the place may be discovered.

Detached REDOUT, is a work made at some distance from the covert-way, much in the same manner as a ravelin with flanks. See **ARROW**.

REDOUTS en cremaillere, differ from all the rest, because the inside line of the parapet is broken in such a manner as to resemble a pot-hook, or teeth of a saw; whereby this advantage is gained, that a greater fire can be brought to bear upon the défilé, than if only a simple face was opposed to it, and consequently the passage is rendered more difficult. See **PL. XV. fig. 2.**

REDOUBT, }
REDUCT, } See **REDOUT**.

REDUCE a place, is to oblige the governor to surrender it to the besiegers, by a capitulation.

RE-ENTERING angle, in *fortification*, is that which turns its point towards the centre of the place. See **FORTIFICATION**.

REFORM, in a *military sense*, is to reduce a corps of men, by either disbanding the whole, or only breaking a part, and retaining the rest; or sometimes by incorporating them with other regiments.

REFORMED-officer, is one whose troop or company is broke, and he continued in whole or half-pay, sometimes doing duty in the regiment: he preserves the right of seniority, and continues in the way of preferment.

REGIMENT, is a body of men, either horse, foot, or artillery, commanded by a colonel, lieutenant-colonel, and major: each regiment of foot is divided into companies, but the number of companies differ; though in England our regiments are generally 10 companies, one of which is always grenadiers, exclusive of the two independent companies. Regiments of horse are commonly 6 troops, but some of 9. Dragoon regiments, are generally in war-time 8 troops, and in time of peace but 6. Each regiment has a chaplain, quarter-master, adjutant, and surgeon. Some German regiments

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consist in 2000 foot, and the regiment of Picardy, in France, in 6000, being 120 companies, of 50 men in each company.

Regiments were first formed in France in the year 1558, and in England in the year 1660.

REGIMENTAL-staff. See **STAFF**.

REGIMENTALS, is the uniform cloathing of the army; and consists in a hat, coat, waistcoat, breeches, shirts, stocks, shoes, stockings, spats, spatterdashes, &c. See **NECESSARIES**.

REGULAR attacks, in a *siege*, are such as are made in form; that is, by regular approaches. See **ATTACKS**.

REINFORCE, in *founding guns*, that part of a gun next to the breech, which is made stronger to resist the force of the powder. There are generally two in each piece, called the first and second reinforce: the second is something smaller than the first, upon the supposition that when the powder is inflamed, and occupies a greater space, its force is diminished, which is a very great absurdity. See **CANNON**.

REINFORCE-ring. There are three in each gun, called the first, second, and third: they are flat mouldings, like flat iron hoops, placed at the breech end of the first and second reinforce, projecting the rest of the metal by about $\frac{1}{4}$ of an inch.

REINFORCEMENT to the army, is an addition of fresh troops to strengthen an army, in order to enable them to go on with an enterprise, &c.

REJOICING-fire, in *military affairs*, is used on obtaining a victory, or on celebrating some public festival. There are, however, two sorts of rejoicing fires; the one by a volley, and the other by a running fire from right to left of the battalion or line. When a volley is to be fired, the battalion or line is to fire together, either by a signal, or by word of command. But should a running fire be made, it is to be performed from right to left in the succession of files; that is, the men of the first file on the right of the battalion are, on the word of command, *Begin*, to pull their triggers; and then, as soon as those of the second file observe the flash in the pans of the first, they are also to pull their triggers; and so on from one file to another, 'till the fire ends with the left hand file of the battalion or line.

RELAIS. See **BERM**, and **FORELAND**.

RELAY-horses, in the *artillery*, are spare horses that march with the artillery and baggage, ready to relieve others, or to assist in getting up a hill, or through bad roads, &c.

RELIEVE

RELIEVE *the guard*, is to put fresh men upon guard, which is generally every 24 hours.

To **RELIEVE** *the trenches*, is to relieve the guard of the trenches, by appointing those for that duty, who have been there before.

To **RELIEVE** *the sentries*, is to put fresh men upon that duty from the guard, which is generally done every two hours, by a corporal who attends the relief, to see the proper orders are delivered to the soldier who relieves.

RELIEVER, an iron ring fixed to a handle by means of a socket, so as to be at right angles to it: it serves to disengage the searcher of a gun, when one of its points is retained in a hole, and cannot be got out otherwise. See **SEARCHER**.

REMOUNT. To remount the cavalry or dragoons, is to furnish them with horses in the room of those which have been either killed or disabled.

RENCOUNTER, in the *military art*, an engagement of two little bodies or parties, detached from the army; in which sense it stands in opposition to a pitched battle.

RENDEZVOUS, } in a *military sense*, the
RENDEVOUS, } place appointed by the general, where all the troops that compose the army are to meet at the time appointed, in case of an alarm. This place should be fixed upon, according to the situation of the ground, and the sort of troops quartered in the village. In an open country it is easy to fix upon a place of rendezvous, because the general has whatever ground he thinks necessary. In towns and villages the largest streets, or market-places, are very fit: but let the place be where it will, the troops must assemble with ease, and proceed to the charge.

REPORTS, in *military matters*, are daily, weekly, and monthly reports, of the state of the companies or regiments, relative to their being absent, present, on duty, sick, confined, &c.

REPRISALS, a right which princes claim of taking from their enemies any thing equivalent to what they unjustly detain from them.

RESERVE, a body of troops sometimes drawn out of the army, and encamped by themselves, in a line behind the lines.

RESERVE-guard, the same as a picquet-guard, except that the one mounts at troop-beating, and the other at retreat-beating.

Body of RESERVE, } in *military affairs*, the
Corps of RESERVE, } third or last line of an army, drawn up in battle; so called, because they are reserved to sustain the rest, as occasion

requires; and not to engage but in case of necessity.

RETIRADE, in *field fortification*, a trench with a parapet; but *retirade* and *coupture*, are commonly taken for a retrenchment formed by the two faces of the re-entering angle in a body of a place, after the first defence is ruined, and the besieged obliged to abandon the head of the work without quitting it entirely; therefore, while some are making head against the enemy, others should be busy in making the retirade; which is sometimes a simple barricade, or retrenchment, thrown up in haste, with a sort of ditch before it.

The *retirade* should be raised as high as possible, and some fougasses made under it, to blow up the enemy's lodgements.

RETREAT, in a *military sense*. An army or body of men are said to retreat when they turn their backs upon the enemy, or are retiring from the ground they occupied: hence, every march in withdrawing from the enemy is called a retreat.

That which is done in sight of an active enemy, who pursues with a superior force, makes my present subject; and is, with reason, looked upon as the glory of the profession. It is a manœuvre the most delicate, and the properest to display the prudence, genius, courage, and address, of an officer who commands: the histories of all ages testify it, and historians have never been so lavish of eulogiums as on the subject of the brilliant retreats of our heroes. If it is important, it is no less difficult to regulate, on account of the variety of circumstances, each of which demands different principles, and an almost endless detail. Hence a good retreat is esteemed, by experienced officers, the master-piece of a general. He should therefore be well acquainted with the situation of the country through which he intends to make it, and careful that nothing is omitted to make it safe and honourable.

RETREAT, is also a beat of the drum, at the firing of the evening-gun; at which the drum-major, with all the drums of the battalion, except such as are upon duty, beats from the camp-colours on the right to those on the left, on the parade of encampment: the drums of all the guards beat also; the trumpets at the same time sounding at the head of their respective troops. This is to warn the soldiers to forbear firing, and the sentinels to challenge 'till the break of day, that the reveille is beat. The retreat is likewise called setting the watch.

RETRENCHMENT,

RETRENCHMENT, in the *art of war*, is any work raised to cover a post, and fortify it against an enemy; such as fascines loaded with earth, gabions, barrels, &c. filled with earth, sand-bags, and generally all things that can cover the men, and stop the enemy: but it is more applicable to a ditch bordered with a parapet; and a post thus fortified, is called a *retrenched post*, or *strong post*. *Retrenchments* are either general, or particular.

General RETRENCHMENTS, are a kind of new fortifications made in a place besieged, to cover the defendents, when the enemy become masters of a lodgement on the fortification, that they may be in a condition of disputing the ground inch by inch, and of putting a stop to the enemy's progress in expectation of relief: as, if the besiegers attack a tenaille of the place, which they judge the weakest, either by its being ill flanked, or commanded by some neighbouring ground; then the besieged make a great *retrenchment*, inclosing all that part which they judge in most danger. These should be fortified with bastions and demi-bastions, surrounded by a good ditch countermined, and higher than the works of the place, that they may command the old works, and put the besiegers to infinite trouble in covering themselves.

Particular RETRENCHMENTS, such as are made in the bastions, when the enemy are masters of the breach. They can never be made but in full bastions; for in empty and hollow ones, *retirades* only can be formed. These particular *retrenchments* are sometimes made at first, which certainly is best. Count Pagan always made a double parapet in all his bastions; and a *retrenchment* made before-hand requires no more men for its defence, than if it were not made; because they never defend it till the principal work is lost. The parapet of such *retrenchment* should be 6 or 8 feet thick, and 5 feet high, with a large and deep ditch, from whence should run out small *fougasses*; and also be countermined.

RETURNS, in a *military sense*, are of various sorts, but all tending to explain the state of the army, regiment, or company; namely, how many capable of doing duty, on duty, sick in quarters, barracks, infirmary, or hospital; prisoners, absent with or without leave; total effective; wanting to complete to the establishment, &c.

RETURNS of a mine, are the turnings and windings of the gallery leading to the mine. See **GALLERY**.

RETURNS of a trench, the various turnings and windings which form the lines of the trench,

and are, as near as they can be, made parallel to the place attacked, to shun being enfiladed. These *returns*, when followed, make a long way from the end of the trench to the head, which going the straight way is very short: but then the men are exposed; yet, upon a sally, the courageous never consider the danger, but getting over the trench with such as will follow them, take the shortest way to repulse the enemy, and cut off their retreat, if possible.

REVEILLE, is the beat of a drum, about break of day, to advertise the army that it is day-light, and that the sentinels forbear challenging.

REVERSE, in a *military sense*, signifies *en the back*, or *behind*: so we say, a *reverse commanding ground*, a *reverse battery*, &c.

REVETEMENT, in *fortification*, a strong wall, built on the outside of the rampart and parapet, to support the earth, and prevent its rolling into the ditch.

When the *revetement* of a rampart goes quite up to the top, 4 feet of the upper part is a vertical wall of 3 feet thick, with a square stone at the top of it, projecting 6 inches, and a circular one below, or where the slope begins, of 8 or 10 inches diameter: they go quite round the rampart, and this circular projection is called the *cordon*.

REVIEW, is the drawing out all, or part of the army in line of battle, to be viewed by the king, or a general, that they may know the condition of the troops.

At all *reviews*, the officers should be properly armed, ready in their exercise, salute well, in good time, and with a good air; their uniform genteel, &c. The men should be clean and well dressed; their accoutrements well put on; very well sized in their ranks; the serjeants expert in their duty, drummers perfect in their beatings, and the fifers play correct. The manual exercise must be performed in good time, and with life; and the men carry their arms well; march, wheel, and form with exactness. All manœuvres must be performed with the utmost regularity, both in quick and slow time. The firings are generally 36 rounds; viz. by companies; by grand divisions; by sub-divisions; obliquely, advancing, retreating; by files; in the square; street firings, advancing and retreating; and lastly, a volley. The intention of a *review* is, to know the condition of the troops, to see that they are complete, and perform their exercise and evolutions well.

RHINELAND rod, is a measure of 12 feet, used by all the Dutch engineers.

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RICOCHET,

RICOCHET, in *gunnery*, is when guns, howitzers or mortars, are loaded with small charges, and elevated from 5 to 12 degrees, so as to fire over the parapet, and the shot or shell rolls along the opposite rampart: it is called *ricochet-firing*, and the batteries are likewise called *ricochet-batteries*. This method of firing was first invented by M. ~~de~~ and first used at the siege of Ath, in 1697. This method of firing out of mortars, was first tried in 1723, at the military school at Strasbourg, and with success. At the battle of Rosbach, in 1757, the king of Prussia had several 6-inch mortars made with trunnions, and mounted on travelling-carriages, which fired obliquely on the enemy's lines, and amongst their horse, loaded with 8 ounces of powder, and at an elevation of 1 degree 15 minutes, which did great execution; for the shells rolling along the lines, with burning fuzes, made the stoutest of the enemy not wait for their bursting.

RIDEAU, in *military affairs*, is a rising ground, or eminence, commanding a plain, sometimes almost parallel to the works of a place: it is a great disadvantage to have rideaus near a fortification, especially when the enemy fire from far, and terminate on the counterscarp: they not only command the place, but facilitate the enemy's approaches.

RIDER, in *artillery carriages*, a piece of wood somewhat higher than broad, the length equal to that of the body of the axle-tree, upon which the side-pieces rest in a four-wheel carriage, such as the ammunition-waggon, block-carriage, and sling-waggons.

RINGS, in *artillery*, are of various uses; such as the lashing-rings in travelling-carriages, to lash the sponge, rammer, and ladle, as well as the tarpauling that covers the guns; the rings fastened to the breeching-bolts in ship-carriages; and the shaft-rings to fasten the harness of the shaft-horse by means of a pin.

RIVETING-plates, in *gun-carriages*, small square thin pieces of iron, through which the ends of the bolts pass, and riveted upon them.

ROCKETS. See **LABORATORY**.

RODS, or *rammers*, either of iron or wood, to drive home the charges of muskets, carbines, and pistols.

Rods, or *sticks*, fastened to sky-rockets, to make them rise in a straight line.

ROLL-calling, in *military matters*, is the calling over of a troop or company by their names, to see they are all present.

Muster-Roll, is a return, which each captain gives the muster-master, on which are

written the names of both officers and soldiers of his company.

To ROLL in duty, is when officers of the same rank take their turns upon duty, as captains with captains, subalterns with subalterns, and command according to the seniority of their commissions.

ROLLERS, are round pieces of wood of about 9 inches diameter, and 4 feet long, used in moving pieces of artillery from one place to another.

RONDEL, in *fortification*, a round tower, sometimes erected at the foot of a bastion.

ROPES, of various lengths and thickness, according to the uses they are made for; such as drays for the gin, for the sling-cart and waggon, &c.

Drag-Ropes, in the *artillery*, by which the soldiers pull the guns backwards or forwards, both at practice and in an engagement, are of the following dimensions, viz. For a 24-pounder, 54 feet long, with the loop-holes for the pegs included, and $5\frac{1}{2}$ inches in circumference; for 18 and 12-pounders, 48 feet long, and 4 inches in circumference; for 6 and 3-pounders, 39 feet long, and $1\frac{7}{8}$ inches in circumference. For 13 and 10-inch howitzers, 45 feet long, and $6\frac{1}{2}$ inches in circumference; for 8-inch howitzers, 48 feet long, and 4 inches in circumference; for all other howitzers, 35 feet long, and 2 inches in circumference.

ROSTER, in *military affairs*, is a plan or table, by which the duty of officers, entire battalions, and squadrons, is regulated.

ROUNDS, in *military matters*, a detachment from the main-guard, of an officer or a non-commissioned officer and 6 men, who go round the rampart of a garrison, to listen if any thing be stirring without the place, and to see that the sentinels be diligent upon their duty, and all in order. In strict garrisons the rounds go every half-hour. The sentinels are to challenge at a distance, and to rest their arms as the *round* passes. All guards turn out, challenge, exchange the parole, and rest their arms, &c.

ROUNDS, are ordinary, and extraordinary. The ordinary rounds are three; the *town-major's round*, the *grand round*, and the *visiting round*.

Manner of going the Rounds. When the town-major goes his *round*, he comes to the main-guard, and demands a serjeant and 4 or 6 men to escort him to the next guard; and when it is dark, one of the men is to carry a light.

As soon as the sentry at the guard perceives the

R O U

the *round* coming, he shall give notice to the guard, that they may be ready to turn out when ordered; and when the *round* is advanced within about 20 or 30 paces of the guard, he is to challenge briskly; and when he has answered by the serjeant who attends the round, *Town-major's round*, he is to say, *Stand, round!* and rest his arms: after which he is to call out immediately, *Serjeant, turn out the guard! town-major's round.* Upon the sentry calling, the serjeant is to turn out the guard immediately, drawing up the men in good order with shouldered arms, the officer placing himself at the head of it, with his arms in his hand. He then orders the serjeant and 4 or 6 men to advance towards the *round*, and challenge: the serjeant of the *round* is to answer, *Town-major's round*; upon which the serjeant of the guard replies, *Advance, serjeant, with the parole!* at the same time ordering his men to rest their arms. The serjeant of the *round* advances alone, and gives the serjeant of the guard the parole in his ear, that none else may hear it; during which period, the serjeant of the guard holds the spear of his halbert at the other's breast. The serjeant of the *round* then returns to his post, whilst the serjeant of the guard, leaving his men to keep the *round* from advancing, gives the parole to his officer. This being found right, the officer orders his serjeant to return to his men; says, *Advance, town-major's round!* and orders the guard to rest their arms; upon which the serjeant of the guard orders his men to wheel back from the centre, and form a lane, through which the town-major is to pass (the escort remaining where they were) and go up to the officer and give him the parole, laying his mouth to his ear. The officer holds the spear of his

S A L

esponton at the town-major's breast while he gives him the parole.

The design of *rounds* is not only to visit the guards, and keep the sentinels alert, but likewise to discover what passes in the outworks, and beyond them.

ROUTE, in *military matters*, an order to direct troops to march the road they are to take, and an authority to the magistrates to provide quarters for them.

ROYALS, in *artillery*, are a kind of small mortars, which carry a shell whose diameter is 5.5 inches. They are mounted on beds the same as other mortars. See *Dimensions of brass land-mortars*, at the word **MORTAR**.

ROYAL academy. See **ACADEMY**.

ROYAL army, an army marching with heavy cannon, capable of besieging a strong fortification, &c.

ROYAL parapet, in *fortification*, a bank about 3 toises broad, and 6 feet high, placed upon the brink of the rampart, towards the enemy: its use is to cover those who defend the rampart.

RUFFLE, } a beat on the drum. Lieutenant

RUFF, } generals have 3 ruffles, major generals 2, brigadiers 1, and governors 1, as they pass by the regiment, guard, &c. See **DRUM**.

To RUN the gantlope, is a punishment for considerable offences. When a soldier is sentenced to run the gantlope, the regiment is drawn out in two ranks facing each other: each soldier, having a switch in his hand, lashes the criminal as he runs along naked from the waist upwards. While he runs, the drums beat at each end of the ranks. Sometimes he runs 3, 5, or 7 times, according to the nature of the offence. The major is on horseback, and takes care that each soldier does his duty.

RUNNING-fire. See **FIRE**.

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SABRE, in *military history*, a kind of sword, or scimeter, with a very broad and heavy blade, thick at the back, and a little falcated, or crooked towards the point.

SAC à terre. See **BAGS**.

SACKS. See **BAGS**.

SAFE-guard, in *military affairs*, a protection granted by a prince or general, for some of the enemy's lands, houses, persons, &c. to preserve them from being insulted or plundered. See **GUARD**.

SAKER, an old word for *cannon*. It carried a shot of 5 pounds and a quarter weight: the diameter of the bore was 3 inches and 9-16ths; the length 8 or 9 feet. See **CANNON**.

SALIENT angle, in *fortification*, that whose points turn from the centre of the place. See **FORTIFICATION**.

SALLY, in a *siege*, when a party of the garrison goes out privately, and falls suddenly on the besiegers in their trenches, endeavouring to drive them out, and destroy their works.

If the garrison is weak, sallies are seldom made; though they fatigue an enemy, obstruct their works, &c. Prudence is the best guide: they should be always bold, daring, secret, and, at various times, equally concerted for the attack as for the defence.

SALTING-boxes, in *artillery*, are boxes of about 4 inches high, and $2\frac{1}{2}$ in diameter, for holding mealed powder, to sprinkle the fuzes of shells, that they may take fire from the blast of the powder in the chamber; but it has been found that the fuze takes fire without this operation with mealed powder, which renders these boxes almost useless.

SALTPETRE, the principal ingredient for making gun-powder; it is found in great plenty in some of the East-India provinces, and in some parts of Europe. See GUN-POWDER.

SALUTE, in *military matters*, a discharge of artillery, or small arms, or both, in honour of some person of extraordinary quality. The colours likewise salute royal persons, and generals commanding in chief; which is done by lowering the point to the ground. In the field, when a regiment is to be reviewed by the king, or his general, the drums beat a march as he passes along the line, and the officers salute one after another, bowing their half-pikes or swords to the ground; then recover, and take off their hats. The ensigns salute all together, by lowering their colours.

SAND, in *military architecture*. The best sand for good mortar, is that whose grain is not too small, and must be clear of the earthy particles. Sand found in rivers is esteemed the best, as having a coarse grain, and being free from earth and mud. See MORTAR.

SAND-bags, in *military affairs*. See BAGS.

SAP, in *sieges*, is a trench, or an approach made under cover of 10 or 12 feet broad, when the besiegers come near the place, and the fire from the garrison grows so dangerous, that they are not able to approach uncovered.

There are several sorts of *saps*; the single, which has only a single parapet; the double, having one on each side; and the flying, made with gabions, &c. In all *saps*, traverses are left to cover the men.

SAPPERS, are soldiers belonging to the royal artillery, whose business it is to work at the saps, and for which they have an extraordinary pay. A brigade of *sappers* generally consists of 8 men, divided equally into two parties; and whilst one of these parties is advancing the sap, the other is furnishing the gabions, fascines, and other necessary implements, who relieve each other alternately.

SARRAZINE. See PORTCULLIS, and HERSE.

SASHES, are badges of distinction, worn by the officers, either round the waist, or over the shoulder. They are made of crimson silk.

SAUCISSE, } in *mining*, is a long pipe or
SAUCISSON, } bag, made of cloth well pitched, or sometimes of leather, of about $1\frac{1}{2}$ inch diameter, filled with powder, going from the chamber of the mine to the entrance of the gallery. It is generally placed in a wooden pipe, called an *auget*, to prevent its growing damp. It serves to give fire to mines, cassions, and bomb-chests, &c.

SAUCISSON, is likewise a kind of fascine, longer than the common ones: they serve to raise batteries, and to repair breaches. They are also used in making epaulements, in stopping passages, and in making traverses over a wet ditch, &c.

SCALADE, in *military affairs*, a furious attack upon a wall or rampart, contrary to form, and with no precaution; frequently carried on with ladders, to insult the wall by open force.

SCALE, in a *military sense*, a right line divided into equal parts, representing miles, fathoms, paces, feet, inches, &c. used in making plans upon paper; giving each line its true length, &c.

SCALING-ladders. See LADDERS.

SCALPING, in *military history*, a barbarous custom, in practice amongst the Indian warriors, of taking off the tops of the scalps of the enemies skulls with their hair on. They preserve them as trophies of their victories, and are rewarded by their chiefs, according to the number they bring in.

SCARP, in *fortification*, is the interior talus or slope of the ditch next the place, at the foot of the rampart.

SCENOGRAPHY, which is also called *profile* or *view*, is the natural representation of a place, such as it appears to us, when we look upon it from without, considering its situation, the form of its walls, the number and figure of its steeples, and the tops of its public and private buildings.

SCONCE, in *fortification*, a kind of small field-fort, built for the defence of some pass, or other post.

SCOUR, or to *scur a line*, is to flank it, so as to see directly along it, that a musket-ball, entering at one end, may fly to the other, leaving no place of security.

SCOUTS, in a *military sense*, are generally horsemen sent out before, and on the wings of an army, at the distance of a mile or two, to discover the enemy, and give the general an account of what they see.

SCREWS,

SCREWS, in *gunnery*, are fastened to the cascable of light guns and howitzers, by means of an iron bolt, which goes through a socket fixed upon the centre transom, to lay the piece with, instead of wedges; as is done in heavy pieces.

SEA-mortars. See **MORTARS**.

SECOND covert-way, that beyond the second ditch. See **FORTIFICATION**.

SECOND ditch, that made on the outside of the glacis, when the ground is low, and water plenty. See **FORTIFICATION**.

SECOND captain. See **CAPTAIN**.

SECOND lieutenant. See **LIEUTENANT**.

SECTION, in *fortification*, is the same with its profile; or a delineation of its heights and depths raised on a plane, as if the works were cut alunder to discover its inside.

SENIORITY, in *military matters*, is the difference of time betwixt the raising of two regiments, whereby the one is said to be so much senior to the other. All regiments take place according to seniority. The difference of time betwixt the dates of two commissions, makes the one senior to the other; and all officers of the same rank, roll by the seniority of their commissions.

SENTINEL, is a private soldier, placed in

SENTRY, some post, to watch the approach of the enemy, to prevent surprises, to stop such as would pass without order, or discovering who they are. They are placed before the arms of all guards, at the tents and doors of general officers, colonels of regiments, &c.

SENTINEL perdu, a soldier posted near an enemy, in some very dangerous post, where he is in hazard of being lost.

SERGEANT, } in *war*, is a non-commissioned officer in
SERGEANT, } sioned or inferior officer in
a company of foot, or troop of dragoons, armed

with a halberd, and appointed to see discipline observed; to teach the private men their exercise; and to order, straiten, and form ranks, files, &c. He receives the orders from the adjutant, which he communicates to his officers. Each company has generally two serjeants.

SERGEANT-major. See **MAJOR**.

SETTERS, in *gunnery*, a round stick to drive fuzes, or any other compositions, into cases made of paper.

SHAFT-rings. See **RINGS**.

SHAFFS of a carriage, are two poles joined together with cross-bars, whereby the hind horse guides the carriage, and supports the fore part of the shafts, the hind part turning round an iron bolt.

SHAFT-bars, are two pieces of wood to fasten the hind ends of the shafts together, into which they are pinned with wooden pins.

SHELLS, in *gunnery*, are hollow iron balls to throw out of mortars or howitzers, with a fuze-hole of about an inch diameter, to load them with powder, and to receive the fuze: the bottom, or part opposite the fuze, is made heavier than the rest, that the fuze may fall uppermost; but in small elevations it is not always the case, nor is it necessary; for, let it fall as it will, the fuze sets fire to the powder within, which bursts the shell, and causes great devastation. The shells had much better be made of an equal thickness, for then they burst into more pieces.

Message-SHELLS, are nothing more than howitz shells, in the inside of which a letter, or other papers, are put; the fuze-hole is flopt up with wood or cork, and the shells are fired out of a royal or howitz, either into a garrison or camp. It is supposed that the person to whom the letter is sent, knows the time, and accordingly appoints a guard to look out for its arrival.

Experiments with loaded SHELLS, in 1761, Prussia.

Nature of mortars	Powder in the chamber	Weight of the mortar	Strokes to drive fuze	Weight of shell fixed	Weight of powd. the shell cont.	Quantity of powder used	Fuze bur.	Elevation	Remarks
inch.	lb. oz.	c. qr. lb.	Nº.	lb. oz.	lb. oz.	lb. oz.	"	"	Pieces the shell broke in
13	4 8	24 2 1	21	194	9 4½	8	16 30	30	18 pieces
	3			192½		7 8	19 45		26 do.
10	3 5	10 2 11	18	90	4 8	3 8	12 35	15	13 do.
	2			89 5		3 12	14 38	30	23 do.
Roy.	10	2 18	12	16	1 2	1	10 28	30	8 do.
	12		12	15 12		14	13 40		19 do.
Coch.	5	2 28	10	8 4	8	7	12 30		6 do.
	5		10	8 5	8	6	14 38	30	12 do.

Weight of land-service SHELLS, and powder to fill them, as also the quantity of powder to burst them into the greatest number of pieces.

Nature	Highest	Medium	Lowest	Powder to fill them	Pow. to burst them in most pieces
	C. Q. lb.	C. Q. lb.	C. Q. lb.	lb. oz.	lb. oz.
13 inch	1 3	1 2 27	1 2 22	9 4½	7 8
10 inch	0 3 9	0 3 5	0 3 1	4 14½	3 4
8 inch	0 1 20	0 1 18	0 1 16	2 3½	2 0
5½ inch	0 0 15	0 0 14½	0 0 14	1 1½	0 14
4½ inch	0 0 8	0 0 7½	0 0 7	0 8	0 7

The above experiments, in 1760, with loaded shells, were the mediums of 6 ranges, and will be of great use to the unexperienced artillerist ;

as the best quantity of powder to make shells burst in the most pieces, is not mentioned by any author I know.

SKINS. *Sheep-skins* are made use of to cover the mortars or howitzers between firing, to prevent any wet or dampness getting into them.

SHOOTING. See GUNNERY, and PROJECTILE.

SHOULDER of a *bastion*. See FORTIFICATION.

SHOULDER-belt, so called because it hangs over the shoulder, to carry the trooper or dragoon's sword : it is made of strong buff leather.

SHOT, a denomination given to all kinds of balls used for artillery and fire-arms ; those for cannon being of iron, and those for guns and pistols, &c. of lead.

Grape
Chain } SHOT. See LABORATORY.
Cafe

Weight and number of SHOT, &c. for TIN CASES, for land and sea service.

Pounders	Land service		Sea service		Weight of the		Length of the		Wooden bottom		Depth of the
	Weight of shot	Number of shot	Weight of shot	Number of shot	Land service case	Sea service case	Land service case	Sea service case	Length	Weight	Groove in the wooden bottom
	oz.	Nº.	oz.	Nº.	oz. dr.	oz. dr.	inch.	inch.	inch.	lb. oz.	inch.
42	6	94	13½	47	15 8		8½		7½	5 2	1¼
32	6	72	8	56	15		8½		5½ ⁶ / ₁₀	4	1
24	4	85	8	42	13 8		8		5	2	1
18	4	62	6	42	9 8		7¾		4½	1 5	1
12	2	84	4	42	7 8		6½		3½	1 1	¾
9	2	63	3	44	5 8		6		3	13	⁶ / ₁₀ or ½
6	1½	56	2	40	4 4		4½ ⁹ / ₁₀		3	8½	⁶ / ₁₀
4			2	28		3 8	4½ ³ / ₁₀		2½ ⁶ / ₁₀	6¼	⁵ / ₁₀
3	1½	34	1½	31	2 4		3½ ⁹ / ₁₀		2½ ⁴ / ₁₀	4½	³ / ₁₀
1½	1½	7			1 14		3½ ⁵ / ₁₀		1½ ⁰ / ₁₀	2½	³ / ₁₀
8 H	6	81			14		6½ ¹ / ₁₀		5	4	1
5½ H	3	55			8 8		4½ ¹ / ₁₀		4	1 8	⁸ / ₁₀
4½ H	2	54			6 8		4½ ¹ / ₁₀		3½	1	⁷ / ₁₀

N. B. H stands for howitzer.

SIDE-

SIDE-pieces, of gun-carriages. See **CARRIAGES.**

SIDE-straps, in a *field-carriage*, are flat iron bands which go round the side-pieces, in those places where the wood is cut across the grain, to strengthen them near the centre and the trail.

SIEGE, in the *art of war*, is to surround a fortified place with an army, and approach it by passages made in the ground, so as to be covered against the fire of the place. See **Pl. XV.**

The first operation of a *siege* is investing: the body of troops investing a town should, at least, be as strong again as the garrison: they divide themselves into several parties, in order to take possession of all the avenues leading to the place. By day they should keep themselves out of cannon-shot; but as soon as it is dusk, they must approach much nearer, the better to be able to support each other, and to straiten the town.

General phrases and terms used at a SIEGE are, viz.

To besiege a place. See **SIEGE.**

To accelerate the SIEGE, is when an army can approach so near the place as the covert-way, without breaking ground, under favour of some hollow roads, rising grounds, or cavities, and there begin their work.

An attack, is when the besieging army can approach the town so near as to take it, without making any considerable works.

To form a SIEGE, there must be an army sufficient to furnish 5 or 6 reliefs for the trenches, pioneers, guards, convoys, escorts, &c. an artillery, with all the apparatus thereto belonging; magazines furnished with a sufficient quantity of all kinds of warlike stores; and an infirmary with physicians, surgeons, medicines, &c.

To raise a SIEGE, is to give over the attack of a place, quit the works thrown up against it, and the posts formed about it. If there be no reason to fear a sally from the place, the *siege* may be raised in the day-time. The artillery and ammunition must have a strong rear-guard, lest the besieged should attempt to charge the rear: if there be any fear of an enemy in front, this order must be altered discretionally, as safety and the nature of the country will admit.

To turn a SIEGE into a blockade, is to give over the attack, and endeavour to take it by famine; for which purpose all the avenues, gates, and streams, leading into the place, are

so well guarded, that no succour can get to its relief.

To insult a work, is a sudden unexpected attack, with small arms, or sword in hand.

Surprise, is the taking a place by stratagem or treason.

To escalade a place, is to approach it secretly, then to place ladders against the wall, or rampart, for the troops to mount and get into it that way.

To petard a place, is privately to approach the gate and fix a petard to it, so as to break it open for the troops to enter.

Line of circumvallation, is a kind of fortification, consisting of a parapet, or breast-work, and a ditch before it, to cover the besiegers against any attempt of the enemy in the field.

Line of countervallation, is a breast work, with a ditch before it, as the line of circumvallation, to cover the besiegers against any sally from the garrison.

Lines, are works made to cover an enemy, so as to command a part of the country, with a breast-work and a ditch before it.

Retrenchment, a work made round the camp of an enemy, to cover it against any surprise.

An epaulement, is a breast-work of 8 or 10 feet high, to cover the cavalry. The breast-work of a battery is also called an epaulement.

Approaches, in a **SIEGE**, are works or trenches which the besieging army make in the ground, in order to approach and make themselves masters of a fortified town, with as little loss as possible.

Counter-approaches, are lines or trenches carried on by the besieged, in attempting to attack the lines of the besiegers in form, or to prevent approaches as much as possible.

Line of counter-approaches, a trench which the besieged make from the covert-way to the right and left of the besiegers attacks, in order to scour their works. This line must be perfectly enfiladed from the covert-way and the half-moon, &c. that it may be of no service to the enemy, in case he gets possession of it.

Batteries at a siege, cannot be erected 'till the trench is advanced within reach of the cannon of the place; that is, within what is generally understood to be a point-blank range, which is reckoned about 300 toises, or 1800 feet.

Cannon is made use of at a *siege* for two different purposes; the first, to drive away the enemy from their defences; and the second, to dismount their guns. To produce these two effects,

effects, the batteries should not be above the mean reach of cannon-shot from the place: therefore there is no possibility of constructing them, 'till the first parallel is formed; and as the distance of the first parallel from the second is generally 300 toises, the batteries must be on this line, or beyond it, nearer the town.

The construction of batteries belongs to the officers of the royal artillery, who generally consult with the engineer that has the direction of the siege, as well about their situation as about the number of their guns and mortars. They must be parallel to the works of the town which they are to batter. It is customary to place the mortar-batteries and gun-batteries side by side, and in the same line, to the end that they may batter the same parts. The use of both, as already observed, is to demolish the enemy's works, to dismount their guns, to penetrate into their powder magazines, and to drive the besieged from their works and defences; as also to ruin and destroy the principal buildings, by setting fire to the town; and to fatigue and distress the inhabitants in such a manner, that they shall press the garrison to surrender.

Bivouac, is an extraordinary guard performed every night during a siege, to prevent any succours from entering the town.

To bombard, is to throw shells into a besieged place, in order to burn and destroy it, and by that means make the besieged capitulate the sooner.

Breach, is an opening made in the wall or rampart of a fortification, with cannon or mines, sufficiently wide for a body of men to enter the works, and drive the besieged out of it.

Camp, in a *siege*, is ranged all along the circumvallation, and within about 120 toises of it: the army fronts the circumvallation; that is, the troops have the line before and the town behind them.

Caissons, are small cases or chests, 2 or 3 feet long, and $1\frac{1}{2}$ foot broad, which are filled with powder, and sometimes with loaded shells: they are set fire to by means of a saucisson, in the same manner as mines; when buried under the glacis, are productive of a very good effect. They should never be placed nearer than 6 or 8 feet to the inside of the covert-way, lest they should damage the troops that defend this post.

Capitulation, the conditions on which a place that is besieged surrenders, being articles agreed on between the besieged and besiegers.

The most honourable and ordinary terms of capitulation are, for the garrison to march out at the breach with arms and baggage, drums beating, colours flying, matches lighted, with some pieces of artillery, waggons, and convoys for their baggage, and for the sick and wounded, &c.

Caponier, a kind of double covert-way, made at the bottom of a dry ditch opposite the curtains, to communicate with the out-works. It also denotes a work or lodgement on the glacis of a place, sunk 4 or 5 feet into the ground, with a parapet on each side, made with the earth thrown out of it, rising about 2 feet above the ground, on which planks are laid, well covered with earth.

Cavalier of the trenches, is an elevation which the besiegers make by means of gabions, within half way or 2-3ds of the glacis, to discover or to enfilade the covert-way. When this work (first invented by Mr. Vauban) is once finished, it is very difficult for the enemy to remain any where in the covert-way; as they would be too much exposed to the troops placed on the cavaliers.

Chamade, is when a town besieged wants to capitulate, or to make some proposals to the besiegers. In that case one or more drums mount the rampart, and beat what the military call a *chamade*.

Chandeliers, are a kind of frames fit for holding a quantity of fascines, in order to cover the workmen from the enemy's fire at a siege. They are made of two pieces of timber, raised perpendicularly on two other horizontal pieces, upon which they are supported on both sides by braces. The space between the two vertical pieces is filled with fascines.

Chevaux-de-frize, are large joists or beams of timber, about 5 or 6 inches square, and 10 or 12 feet long, through which pass a number of wooden pins about 6 feet long, and $1\frac{1}{2}$ inch diameter, shod with iron. They are made use of to stop up narrow passages, breaches, &c. during a siege.

Circumvallation, a work made of earth, consisting of a parapet and a ditch, with which towns are surrounded when besieged. Very seldom used now.

To clear, is said of those who make a sally, when they fill up the trench and beat off the enemy.

Countervallation, is a fortification made of earth like that of the circumvallation, the intent of which is to secure the troops employed in the *siege* against any insult from the garrison.

The

The besieging army is between the circumvallation and the countervallation. The first fronts the county, and the second the town. Almost out of use at present.

Epaulement, is the parapet of a battery of cannon or mortars at a siege. This name is also given to elevations of earth, which are sometimes made in the lines, to cover the cavalry from the fire of the place. In a siege, *épaulements* are generally made 9 or 10 feet high, near the entrance of the approaches.

Escalade, is the attack of a place by surprise, and getting over the walls or rampart by the assistance of ladders.

Fascines, are a kind of faggots made of small branches of trees, or brush-wood, tied in 4 or 5 places; they are made from 2 to 10 feet long, and about 1 or 1½ feet diameter. Frequently used in sieges.

Pitched fascines, are such as are daubed over with pitch and tar, in order to destroy the enemy's works.

Front attack, that part of a fortification, against which the besiegers make their approaches, and point their artillery.

Blinds, are wooden frames of 4 pieces, round or flat, two of which are 6 feet long, and pointed at the ends, and the others 3 or 4 feet, which serve as spars to fasten the two first together. Their use is to fix them upright against the sides of the saps, to sustain the earth, and to fasten the fascines on the upper part, or to cover the sap, and to lay fascines over them, to secure the troops from stones and grenades.

Gabions, are a kind of baskets without a bottom, every where equally wide, 5 or 6 feet high, and about 3 in diameter, having 9 or 10 staves of about 1½ inch in diameter; which exceed the basket-work 5 or 6 inches, and are pointed, so as to stick into the ground. They are generally made by the miners and sappers.

Stuffed gabions, are large gabions filled with different things, to prevent their being perforated by musket-shot: the sappers roll them before them, to cover themselves against the fire of the place.

Herissons, are large beams or trees, of the length of a breach made in a fortification, stuck thick with iron spikes, and rolled down upon the breach, to hinder the besiegers from mounting: they are sometimes made to slide with rollers.

Inflicting a work, is to make a sudden and open attack upon it.

Investing a place, is to surround it with troops on all sides, so that the town shall receive no

succours of men or provisions. This is properly the first operation of a siege. The body of troops investing a town should at least be as strong again as the garrison: they are to divide themselves into several parties, the better to take possession of all the avenues leading to the place. By day they should keep themselves out of the reach of cannon-shot; but as soon as it is dark, they must approach much nearer, the better to be able to support each other, and to straiten the town.

The *investing* is generally made by cavalry; but when the country is cut with ravins, or hollow ways, or when there are woods in the neighbourhood of the place, then there must be likewise a body of infantry to guard all the avenues, and even to stop up, by a kind of retrenchments, such as might be the easiest to penetrate.

A few days after the *investing*, the besieging army arrives, and is disposed of round the town by the engineer, who directs the siege, and the lines are opened, &c.

Line of circumvallation. See CIRCUMVALLATION.

Line of countervallation. See COUNTERVALLATION.

Line of counter-approach. See APPROACH.

Lodgement, is a kind of retrenchment made openly in some part of a work, from whence the enemy have been driven, in order to maintain that post, and to be covered from the fire of the neighbouring works. It is always made by the besiegers in some part of a fortification, after the besieged have been driven out.

Opening of the trenches, is when the workmen begin to dig them, at the first commencement of a siege.

Parallels, or places of arms, are a part of the trenches, which surround the whole front attacked, and serve to hold the soldiers, who are to protect and support the workmen: they are about 8 or 10 feet deep, and 16 or 18 feet wide.

Park, in artillery, is the place where all the ammunition and magazines are secured for an army carrying on a siege. It must be in some part most remote from the town, and the least exposed to be insulted, but on the same side where the attack is to be made: it is generally made in the form of a square redoubt, with a breast-work and a ditch round it, and the entrance covered with a redan, or small ravelin.

Pickets, are a kind of stakes, sharp at one end, to hold the fascines together in making saps, lodgements, and filling up of ditches, &c.

in a siege. They are 3 feet long, and about $1\frac{1}{2}$ inch diameter.

Place of arms, in the operations of a siege, is what we generally call the parallels. They are the parts of a trench opposite to the front attacked.

Place of arms, in a dry ditch, is a kind of covert-way made at the extremity of the faces to defend the ditch at a siege.

Quarter, at a siege, is a part of the army, consisting of one or more brigades, and generally under the command of a general officer. It likewise implies the incampment of the besiegers.

Sally, at a siege, is when a body of troops go privately out of a besieged town, fall suddenly upon the besiegers, and destroy part of their works, nail their cannon, and do every other damage they can.

Sand-bags, are made about 2 feet high, and 8 or 10 inches diameter: they are filled with earth, and cover the workmen in making their approaches. They are sometimes placed on the ramparts, three together, for the troops to fire through.

Saps, in a siege, are trenches made under cover from the fire of the place, behind a mantlet or stuffed gabion: they are generally 10 or 12 feet broad. This work differs from the trenches, in as much as the latter are made uncovered. The sap has also less breadth; but when it is as wide as the trench, it bears the same name. There are various sorts of saps, viz.

Single sap, is that which is made on one side only, or, which is the same thing, has only one parapet.

Double sap, has a parapet on each side, and is carried on wherever its two sides are seen from the place.

Flying sap, is that in which the besiegers do not give themselves the trouble of filling the gabions with earth: it is made where the workmen are not much exposed, and in order to accelerate the approaches.

Sap-saggets, are a kind of fascines, but only 3 feet long, and about 6 inches in diameter.

Sap-logs, are another species of fascines, from 12 to 19 feet long, and from 8 to 10 inches in diameter, and are used in making batteries, and repairing the breaches.

Serlis. See *Sally*.

Tail, or *rear of the trench*, is the first work the besiegers make when they open the trenches.

Tambou, is a kind of traverse, at the upper end of the trench or opening made in the glacis to communicate with the arrows. This work

hinders the besiegers from being masters of the arrow, or discovering the inside of the place of arms belonging to the covert-way.

Traverses, in a siege, is a name given to a kind of retrenchment made in the dry ditch, to defend the passage over it.

Trenches, are a kind of passages or turnings dug in the earth, in order to approach a place without being seen from its defences.

To turn a work, is to cut off its communication with the place, endeavouring to take it by its gorge. A work is said to be turned when the besiegers get between that work and the place.

Wool-packs, used in a siege, differ from sand-bags, in this only, that they are much larger, and instead of earth they are filled with wool. They are used in making lodgements in places where there is but little earth, and for other similar purposes. They are about 5 feet high, and 15 inches diameter.

Rear of an attack, is the place where the attack begins.

Front, or head of an attack, that part next to the place.

Mantlets, are wooden fences, rolling upon wheels, of 2 feet diameter; the body of the axle-tree is about 4 or 5 inches square, and 4 or 5 feet long; to which is fixed a pole of 8 or 10 feet long, by two spars; upon the axle-tree is fixed a wooden parapet, 3 feet high, made of 3-inch planks, and 4 feet long, joined with dowel-pins, and two cross-bars: this parapet leans somewhat towards the pole, and is supported by a brace, one end of which is fixed to the pole, and the other to the upper part of the parapet. They are used to cover the sappers in front against musket-shot.

Crows-feet, or } is a kind of iron, with 4 points,
Chausse-trap, } so disposed, as always to have 3 points downwards, and 1 upwards: they serve also to stop the horse.

Maxims in sieges are, 1st. The approaches should be made without being seen from the town, either directly, obliquely, or in the flank.

2. No more works should be made than are necessary for approaching the place without being seen; i. e. the besiegers should carry on their approaches the shortest way possible, consistent with being covered against the enemy's fire.

3. All the parts of the trenches should mutually support each other; and those which are farthest advanced, should be distant from those that defend them above 120 or 130 toises, that is, within musket-shot.

4. The

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4. The parallels, or places of arms the most distant from the town, should have a greater extent than those which are the nearest, that the besiegers may be able to take the enemy in flank, should they resolve to attack the nearest parallels.

5. The trench should be opened or begun as near as possible to the place, without exposing the troops too much, in order to accelerate and diminish the operations of the siege.

6. Care should be taken to join the attacks; that is, they should have communications, to the end that they may be able to support each other.

7. Never to advance a work, unless it be well supported; and for this reason; in the interval between the 2d and 3d place of arms, the besiegers should make, on both sides of the trenches, smaller places of arms, extending 40 or 50 toises in length, parallel to the others, and constructed in the same manner, which will serve to lodge the soldiers in, who are to protect the works designed to reach the 3d place of arms.

8. Observe to place the batteries of cannon in the continuation of the faces of the parts attacked, in order to silence their fire; and to the end that the approaches, being protected, may advance with great safety and expedition.

9. For this reason the besiegers shall always embrace the whole front attacked, in order to have as much space as is requisite to place the batteries on the produced faces of the works attacked.

10. Do not begin the attack with works that lie close to one another, or with reentrant angles, which would expose the attack to the cross fire of the enemy.

Stores required for a month's SIEGE are as follow:

Powder, as the garrison is more or less strong	-	- 8 or 900,000 lb.
Shot { for battering pieces	-	6000
{ of a lesser fort	-	20,000
Battering cannon	-	80
Cannons of a lesser fort	-	40
Small field-pieces for defending the lines	-	20
Mortars for throwing { shells	-	24
{ stones	-	12
Shells for mortars	-	15 or 16,000
Hand grenades	-	40,000
Lead bullets	-	180,000
Matches in braces	-	10,000
Flints for muskets, best sort	-	100,000

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Platforms complete for guns	-	125 lb.
Platforms for mortars	-	60
Spare {	carriages for guns	- 60
	mortar-beds	- 60
	spunges, rammers, and ladles, in sets	20
Tools to work in trenches	-	45,000

Several hand-jacks, gins, sling-carts, travelling forges, and other engines proper to raise and carry heavy burthens; spare timber, and all sorts of miners too's, mantlets, stuffed gabions, fascines, pickets, and gabions.

SIGNAL, in the *art of war*, a certain sign agreed upon for the conveying intelligence, where the voice cannot reach. *Signals* are frequently given for the beginning of a battle, or an attack, usually with drums and trumpets, and sometimes with sky-rockets, &c.

SIGNAL-flags, in *ancient military history*, was a gilded shield hung out of the admiral's galley; it was sometimes a red garment or banner, termed *ῥοδὸν σημαῖον*. During the elevation of this the fight continues, and by its depression or inclination towards the right or left, the rest of the ships were directed how to attack their enemies, or retreat from them.

SILLON, in *fortification*, is a work raised in the middle of a ditch, to defend it when it is too wide. It has no particular form; sometimes made with little bastions, half-moons, and redans, which are lower than the works of the place, but higher than the covert-way. It is more frequently called *envelope*, which see.

SIMILAR polygons, are such as have their angles severally equal, and the sides about those angles proportional.

SIMITAR, in *war*, a crooked or falcated sword, with a convex edge. Not in use now.

SIXAIN, in *ancient military history*, an order of battle, wherein six battalions being ranged in one line, the 2d and 5th are made to advance, and form the van-guard; the 1st and 6th to retire, and form the rear-guard; the 3d and 4th, remaining on the spot, to form the body of the battle.

SKIRMISH, in *war*, a disorderly kind of combat, or encounter, in presence of two armies, between small parties who advance from the main body for that purpose, and introduce, or invite to, a general fight.

SLEEPERS, the undermost timber of a gun or mortar-battery. See **PLATFORM**.

SLEETS, are the parts of a mortar going from the chamber to the trunnions, to strengthen that part.

SLING-cart. See **CARRIAGE**.

SOCIETY,

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SOCIETY, in *general*, denotes a number of persons united together for their assistance in promoting the arts and sciences, security, interest, or entertainment.

SOLDIER, a military man listed to serve a prince or state, in consideration of a certain daily pay.

SOLDIERS are properly the land-forces of a kingdom, or state; but in England it is against the ancient law to keep an army of soldiers in time of peace. Where any soldier that is lawfully retained shall depart from his colours without leave, he is declared to be guilty of felony by 18 Hen. VI. c. 9. and every soldier, who either causes a mutiny, or deserts the service, shall be punished with death, or otherwise, as a court-martial shall think fit. All persons suspected of desertion are to be apprehended by constables, who shall be allowed a reward of twenty shillings for every such deserter.

By 4 Geo. I. c. 4. it is ordained, that no soldier shall be taken out of the service by any process in law, unless it be for some criminal matter, or where the debt he owes amounts to ten pounds at the least; of which affidavit is to be made, &c. Soldiers must be quartered in inns and ale-houses only, and not in private houses, without the consent of the owners, under certain penalties; and where victuallers refuse soldiers quartered on them, or constables receive any reward for excusing their neglect, they forfeit a sum not above fifty pounds, nor under thirty shillings, by 3 Geo. II. c. 2. A person enlisted for a soldier, within four days after, is to be carried before the next justice or

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chief magistrate of a town, and is to declare his assent that he listed voluntarily, &c.; but if he then dissents therefrom, on his returning the money received, and paying twenty shillings, he may be discharged. In case any subject of Great-Britain or Ireland shall list or enter himself, or procure any one to be enlisted a soldier to go beyond the seas, without leave obtained from his Majesty, such person shall be punished as a felon by 8 and 9 Geo. II. There are acts annually made for punishing mutiny, &c. of soldiers and false musters, and for the better payment of the army and their quarters.

SOLID bastion. See FORTIFICATION.

SOMMERS, in an *ammunition-waggon*, are the upper sides, supported by the staves entered into them with one of their ends, and the other into the side-pieces.

SORTIES, in a *siege*, parties that fall out of a town secretly to annoy the besiegers, and retard their operations.

SOUND. The experiments are numerous by which it has been found, that sound is audible to the distance of 50, 60, or 80 miles; but Dr. Hearne, physician to the king of Sweden, tells us, that at the bombardment of Holmia, in 1658, the sound was heard 30 Swedish miles, which make 180 of ours: and in the fight between England and Holland in 1672, the noise of the guns was heard even in Wales, which cannot be less than 200 miles.

The velocity of sound is 380 yards, or 1142 feet in a second of time, as found by very accurate experiments. Hence the following

Table of the progression of Sound.

seconds	yards	feet	inches	seconds	yards	feet	inches	seconds	yards	feet	inches	seconds	yards	feet	inches	seconds	yards	feet	inches
1	380	2		4½	1731			8	3045	1		11½	4377	2		15	5710		
1½	475	2	6	4¾	1808	1		8¼	3140	1	6	11¾	4472	2	6	1½	5805		6
1½	571			5	1903	1		8½	3235	2		12	4568			15½	5900	1	
1¾	656		6	5½	1998	1	6	8¾	3310	2	6	12¼	4663		6	15¾	5995	1	6
2	761	1		5½	2093	2		9	3426			12½	4758	1		16	6090	2	
2¼	856	1	6	5¾	2188	2	6	9¼	3521		6	12¾	4853	1	6	16¼	6185	2	6
2½	951	2		6	2284			9½	3616	1		13	4948			16½	6281		
2¾	1046	2	6	6¼	2379		6	9¾	3711	1	6	13¼	5043		6	16¾	6376		6
3	1142			6½	2474	1		10	3806	2		13½	5139			17	6471	1	
3¼	1239		6	6¾	2569	1	6	10¼	3901	2	6	13¾	5234		6	17¼	6566	1	6
3½	1332	1		7	2664	2		10½	3997			14	5329	1		17½	6661	2	
3¾	1427	1	6	7¼	2759	2	6	10¾	4052		6	14¼	5421	1	6	17¾	6756	2	6
4	1522	2		7½	2855			11	4187	1		14½	5469	2		18	6851		
4¼	1617	2	6	7¾	2950		6	11¼	4282	1	6	14¾	5574	2	6	18¼	6946		6

By this table we can easily measure the distance of the clouds producing thunder and lightening; for suppose, from the moment we observe the flash, to the moment we hear the stroke of thunder, we count four seconds; which find in the table; and opposite thereto, you will find 1522 yards, 2 feet, for the distance of the cloud. In like manner the distance of ships at sea, of batteries in a siege, &c. is known by firing of guns. *Example:* On seeing the flash of powder, count the seconds 'till you hear the report, which suppose 2½, the number opposite thereto is 856 yards, 1 foot, and 6 inches, the distance of the gun from the place you stand at. The horizontal range of a shell may likewise be found in this table. *Example:* Square the number of seconds, multiply that product by $16\frac{1}{12}$, and divide by 3, which gives the number of yards of a horizontal projection at 45° : or, to avoid fractions, multiply the seconds by 193, and divide by 36, which gives the same answer. For $12 \times 12 = 144 \times 16\frac{1}{12} =$

$$\frac{2116}{3} = 772: \text{ or } 12 \times 12 = 144 \times 193 = \frac{27702}{36} = 771 \text{ as before.}$$

The exactness of measuring distances by sound, has been sufficiently proved, by measuring the same distances by trigonometry.

SOW, in *ancient military history*, a kind of covered shed, fixed on wheels, under which the besiegers filled up and passed the ditch, sapped or mined the wall, and sometimes worked a kind of ram. It had its name from its being used for rooting up the earth like a swine, or because the soldiers therein were like pigs under a sow.

SPATTERDASHES, a kind of covering for the legs of soldiers, made of coarse linen waxed over, and buttoned tight; by which the wet is kept off.

SPATTS, a small fort of spatterdashes, that reach only a little above the ankle, much worn by the royal artillery, and gentlemen cadets.

SPIES, in *war*, are persons employed to give

give intelligence of what the enemy is doing. They should be well paid: who pays them ill, is never well served. They should never be known to any body, nor should they know one another. When they propose any thing very material, secure their persons, or have their wives and children as hostages for their fidelity. If they are apprehended, they immediately suffer death.

SPIES are found in the cabinets of princes, in the closets of ministers, amongst the officers of the army, and in the councils of generals; in towns belonging to the enemy, and in monasteries. The greatest generals strongly recommend them, whatever expence they may occasion; and indeed a commander had better be in want of many particulars, however necessary, than be destitute of spies. Nothing should be spared to procure them; and even the promises made to them should be observed with the most inviolable integrity.

SPLICE, A rope is said to be *spliced*, when the several strands of each end, being untwisted, are wrought into one another in a peculiar manner, known to all artillery-men.

SPIKES, in *gunnery*. See **HAND-SPIKES**.

SPIN, or to *spin bay*, is to twist it up in ropes, very hard, for an expedition; by which means it is less bulky, and less troublesome for the cavalry to carry behind them. An expert horseman can spin five days forage into a very narrow compass.

SPONTOON, is a weapon much like a halberd, now used instead of a half-pike by the officers of foot. When the spontoon is planted, the regiment halts; when pointed forwards, the regiment marches; and when pointed backwards, the regiment retreats.

SPONGE, in *gunnery*, is a cylinder of wood fixed to a handle, whose diameter and length are equal to the shot in guns, covered with a lamb-skin to clean the piece with, after it has been fired.

SPURS, in *old fortifications*, are walls that cross a part of the rampart, and join to the town-wall.

SQUADRON, a body of cavalry, composed of three troops. The number is not fixed, but is generally from 80 to 120 men. The eldest troop always takes the right of the squadron, the second the left, and the youngest the centre.

SQUADS, in a *military sense*, are certain divisions of a company into so many squads, generally into 3 or 4. The use of forming companies into as many squads of inspection as it has serjeants and corporals, is proved by those

regiments who have practised that method; as by it the irregularity of the soldiers is considerably restrained, their dress improved, and the discipline of the regiment in general most remarkably forwarded. Every officer should have a roll of his company by squads.

SQUARE battalion of men, is that which is composed of an equal number of men in rank and file. To make a square battalion of men, whose number is known, as 50, take the nearest square root, which is 5; for the number of men in rank and file.

SQUARE battalion of ground, the number being likewise determined, as 60, that number must be multiplied by 3, the number of feet that each man takes in front, and the product, 180, divided by 7, the number of feet each man takes up in depth, or the distance of the ranks: the quotient is 25, the square root of which is 5, the number of men in each file: by the root 5 you divide 60; the quotient is 12, the number of men in each rank.

Solid SQUARE, is a body of foot, where both ranks and files are equal. It was formerly held in great esteem; but when the prince of Nassau introduced the hollow square, this was soon neglected. Both the solid and hollow square are almost exploded from tactics.

Hollow SQUARE, is a body of foot drawn up with an empty space in the centre, for the colours, drums and baggage, facing every way to charge the horse.

STAFF, in *military matters*, consists of a quarter-master-general, adjutant-general, and majors of brigade. The staff properly exists only in time of war. See **QUARTER-MASTER-GENERAL**, &c.

Regimental STAFF, consists in the adjutant, quarter-master, chaplain, and surgeon, &c.

STANDARD, in *war*, a sort of banner or flag, borne as a signal for the joining together of the several troops belonging to the same body.

The standard is usually a piece of silk $1\frac{1}{2}$ feet square, on which is embroidered the arms, device, or cypher, of the prince or colonel. It is fixed on a lance 8 or 9 feet long, and carried in the centre of the first rank of a squadron of horse, by the cornet.

STAPLES, in *artillery carriages*, are driven into the side-pieces of gun and mortar carriages, to fasten the keys of the eye-bolts by means of chains: there are also staples to the lockers of gun-carriages, &c.

STAR-fort, in *fortification*. See **FORT**, and **FORTIFICATION**.

STAVES, round and flat, used in ammunition

tion and other waggons or carts, are round and flat sticks between the sommers and side-pieces, also in common and scaling ladders.

STAYS, in *truck carriage*, are the irons which are fixed one end under the fore axle-tree, and the other to the side-pieces, in the form of an S.

STEGANOGRAPHY, the art of secret writing, or of writing in cyphers, known only to persons corresponding, and much used in the army.

STOLF. See **ORDER OF THE STOLE**.

STONES, in *military architecture*, may be distinguished into two sorts; that is, into hard and soft: hard stone is that which is exposed to the open air, such as rocks, and which lies loose upon the surface of the earth: the soft stone is that which is found in quarries, and under ground. It is undoubtedly true that the hardest stones make the most durable works; but as there is seldom a sufficient quantity to build the whole fortification, the best serve in the facings of the work, in the foundations, and where the works are exposed to the violence of the waves.

The stones of some quarries are very soft, and easily worked, when first taken out; but, when exposed for some time to the open air, become very hard and durable.

As there is undoubtedly a kind of sap in stones as well as in timber, by which the same sort of stone, taken out of the same quarry, at one season, will moulder away in a few winters, but, when dug out in another season, will resist the weather for many ages; stones should always be dug up in the spring, that they may have time to dry before the cold weather comes in; for the heat of the sun will extract the greatest part of the moisture, which otherwise expands in frosty weather, and causes the stone to splinter (as example teaches) although it is otherwise hard and good.

As stones lie in the quarries in horizontal beds or strata, (that is, they cleave in that direction) and have likewise a breaking vein, which is perpendicular to the former; both these directions must be observed in cleaving, as well as raising them out of their beds. Stones that will not easily cleave must be blown up by gunpowder.

Marble, is of various sorts and colours; the most beautiful of which is exported from abroad. The marble found in England is mostly blackish, and so very hard and difficult to polish, that very little use is made of it, except to burn and make lime.

Fire-STONES, come from Reygate, and serve chiefly for chimneys, hearths, ovens, furnaces, and stoves; being a dry, porous, gritty stone, which bears the heat without breaking: on account of this quality, it is called *fire-stone*.

Purbeck-STONE, is a hard, greyish stone, and serves chiefly for paving, coping of walls, and for all such other uses where strength is required, it being the most hard and durable stone, except the Plymouth marble. It is found on Purbeck island.

Rag-STONE, is of a bluish colour, and commonly used in paving: but there is a stone called *Kentish rag*, that is very useful in building; they split very easily, and yet are very hard.

Free-STONE, more generally called *Portland-stone*: it is a fine whitish stone, without any veins. This stone is very soft when it comes out of the quarry, works very easily, and becomes very hard in time. Hence it is very fit for military works. It costs about nine-pence a cubic foot upon the spot.

Alabaster, is a clear whitish stone, not unlike coarse marble. It is plentiful in some parts of Italy; but there is none to be found in England. It is to be had in great abundance in Scotland, and makes the very best of lime.

Whin, or *Aberdeen whin*, is of a greyish colour, intermixed with veins, not unlike coarse marble. This stone is the fittest of any for military works; because it withstands the weather, and the violence of the waves, better than any stone found in England.

STOPPAGES, in a *military sense*, is a deduction of some part of a soldier's pay, the better to provide him with necessaries. A soldier should never be put under a greater weekly stoppage from his pay, than what will afterwards leave him a sufficiency for messing. Six-pence a week, besides arrears, is as much as they can spare.

STORE-keeper, in *war-time*, must take care of the stores in the magazines, such as the provisions, forage, &c. receive the same from the contractors, and deliver them out to the troops. He has several clerks under him, appointed to the different departments, of provisions, hay, straw, oats, &c. In time of peace he has charge of all the king's stores, belonging both to land and sea-service.

STORM, in *military affairs*. See **STRATAGEM**.

STRATARITHMOMETRY, in *war*, the art of drawing up an army, or any part of it, in any

any given geometrical figure; and of expressing the number of men contained in such a figure, as they stand in order of battle, either at hand, or at any distance assigned.

STRATAGEM, in *war*, any device for the deceiving and surprising an army, or any body of men. See **SURPRISE**.

STRAW. *Par/straw!* is a word of command to dismiss the soldiers when they have grounded their arms, so that they may be ready on the first signal given.

STRAPS, are the iron bands on the outside of the wheel to bind the fellys strongly together.

STREAK-nails, are those driven through the streaks into the fellys.

SUBALTERN. See **OFFICER**.

SUB-brigadier, an officer in the horse-guards, who ranks as colonel.

SUB-lieutenant, an officer in the royal regiment of artillery and fuzileers, where they have no ensigns; and is the same as second lieutenant.

SUBORDINATION, in *military matters*, consists in a perfect submission to the orders of superiors; in a perfect dependence, regulated by the rights and duties of every military man, from the soldier to the general. *Subordination* should show the spirit of the chief in all the members; and this single idea, which displays itself to the least attention, suffices to show its importance. Without *subordination* it is impossible that a corps can support itself; that its motions can be directed, order established, or the service carried on. In effect, it is *subordination* that gives a soul and harmony to the service; it adds strength to authority, and merit to obedience; it supports the staff of the marshal, as the sword of the soldier, which secures the efficacy of the command, and the honour of the execution: it is *subordination* which prevents every disorder, and procures every advantage to an army.

SUBSISTENCE, in the *military art*, is the money paid, weekly or monthly, to both officer and soldier, but not amounting to their full pay: the difference is called *arrests*. See **PAY**.

SUCCOUR, in *war*, the effort made to relieve a place; that is, to raise the siege, and force the enemy from it.

SULPHUR, or *brimstone*, a mineral, very useful in making gun-powder and artificial fire-works.

SURFACE, in *fortification*, is that part of the side which is terminated by the flank prolonged, and the angle of the nearest bastion:

the double of this line with the curtain is equal to the exterior side.

SURPRISE, in *war*, to fall on an enemy unexpectedly, in marching through narrow and difficult passes, when one part has passed, so as not easily to come to the succour of the other; as in the passage of rivers, woods, enclosures, &c. A place is surprised by drains, case-mates, or the issues of rivers or canals; by encumbering the bridge or gate, by waggons meeting and stopping each other; sending soldiers into the place, under pretence of being deserters, who, on entering, *surprise* the guard, being sustained by troops in ambush near the place, to whom they give entrance, and seize it; soldiers sometimes dressed like peasants, merchants, Jews, priests, or women. The enemy sometimes send in their soldiers, as if they were yours coming from the hospital, &c. they also dress their soldiers in your regimentals, who, presenting themselves at your gate as such, are immediately admitted, seize the guard, and become masters of the place. Sometimes houses are set on fire, and whilst the garrison comes out to extinguish it, troops who lay in ambush march in, and surprise the place. Officers commanding guards at the principal gates are lured out under various pretences, so contrived as to seize the gate in coming in with them. Sometimes an alarm is given at one side of the garrison, whilst you enter secretly at the other, at that time too often neglected.

SURRENDER, in *war*, to lay down your arms, and surrender yourself prisoner; to give over a town, post, or other fortification, agreeably to articles, &c.

SURVEYOR of the ordnance. See **ORDNANCE**.

SUTLER, in *war*, one who follows the army, and furnishes provisions for the troops. They pitch their tents, or build their huts in the rear of each regiment, and about head quarters.

SWALLOWS-tail, in *fortification*, an out-work, differing from a single tenaille, as its sides are not parallel, like those of a tenaille; but if prolonged, would meet and form an angle on the middle of the curtain; and its head or front composed of faces, forming a re-entering angle. This work is extraordinarily well flanked, and defended by the works of the place, which discover all the length of its long sides, &c.

SWEEP-bar, of a waggon, is that which is fixed on the hind part of the fore-guide, and passes under the hind pole, which slides upon it.

SWING-

SWING-tree, of a waggon, the bar fastened across the fore-guide, to which the traces of the horses are fastened.

SWORD, an offensive weapon worn on the left side, and serving either to cut or stab: its parts are the handle, guard, and blade; to which may be added the bow, scabbard, chape, and pommel.

Broad-Sword, an original weapon of Scotland; it is sometimes called a back-sword, as having but one edge: it is basket-handled, and 3 feet 2 inches long.

Sword-belt, generally made of leather, sometimes of silk, and sometimes of steel chains: it is worn about the waist, to carry the sword in.

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TABLES, in *military affairs*, a kind of register to set down the dimensions of carriages for guns, mortars, &c. also for the practice of artillery, charges of mines, &c. See **SUPPLEMENT**.

TACKLES, are more particularly used for small ropes running in pulleys, the better to manage all kinds of ordnance. See **GIN**.

TACTICS, in the *art of war*, the art of disciplining armies, and ranging them into forms proper for fighting and manœuvring, &c.

In the time of the Romans, the Gauls and other nations on the continent fought in the phalanx order. It is this order which still prevails through all Europe, except that it is deficient in the advantages and utility which Polybius ascribes to it, and is injured and disgraced by defects unknown in the ancient phalanx.

In Turenne's days troops were ranged 8 deep both in France and Germany. Thirty years after, in the time of Puysegur, the ranks were reduced to 5, in the last Flanders war to 4, and immediately after to 3.

This part of the progression from 8 to 3, being known, we easily conceive how the files of the phalanx had been diminished from 16 to 8, in the ages preceding Turenne. It is to be presumed that this depth was considered as superfluous, and it was judged necessary to curtail it, in order to extend the front. However, the motion is of very little consequence; we are now reduced to 3 ranks: let us endeavour to find out what qualities of the phalanx have been preserved, and what might have been added thereto.

To shew that we have preserved the defects

of the phalanx in Europe, I suppose 2 bodies of troops, one of 8,000 men, ranged as a phalanx, 15 deep; the other, a regiment of 3 battalions, consisting only of 1500 men, drawn up in 3 lines after the same manner. Those two bodies shall be perfectly equal in extent of front, and shall differ in nothing but in the depth of their files: the inconveniences and defects, therefore, occasioned by the length of the fronts, are equal in both troops, though their numbers are very different: hence it follows, that in Europe the essential defects of the phalanx are preserved, and its advantages lost.

Let the files of this body, of 8,000, be afterwards divided, and let it be reduced to 3 in depth; its front will then be found 5 times more extensive, and its depth 5 times less: we may therefore conclude, that the defects of the phalanx are evidently multiplied in the tactics of Europe, at the expence of its advantages, which consisted in the depth of its files.

The progress of the artillery has contributed greatly to this revolution. As cannon multiplied, it was necessary to avoid its effects; and the only method of doing it, was doubtless to diminish the depth of the files.

TAIL of the trenches, is the post where the besiegers begin to break ground, and cover themselves from the fire of the place, in advancing the lines of approach. See **TRENCHES**.

TALUS, in *fortification*, a slope made to the works of a fortification, both on the outside and inside, to prevent the earth from rolling down.

Exterior TALUS, is the outside slope of a work towards the country, and should be as small as possible, that the enemy may not find it easy to be mounted, either by escalade or otherwise: but if the earth be not good, the talus must be large, that it may keep it up the better: then it is necessary to support the earth with a slight wall, called a *revêtement*.

Interior TALUS, the inside slope of a work next the town, which is much larger than that of the outside, and has, at the angles of the gorge, and sometimes in the middle of the curtain, ramps or sloping roads, to mount upon the terre-plein of the rampart. The interior talus of the parapet should be very small, that men may fire over it with more ease.

Superior TALUS of the parapet, is a slope on the top of the parapet, that allows of the soldiers defending the covert-way with small shot, which they could not do were it level.

TAMBOUR, in *fortification*, is a kind of work formed of palisades, or pieces of wood, 10 feet long, and 6 inches thick, planted close together, and driven 2 or 3 feet into the ground; so that, when finished, it may have the appearance of a square redout cut in two. Loop-holes are made 6 feet from the ground, and 3 feet asunder, about 8 inches long, 2 inches wide within, and 6 without. Behind is a scaffold 2 feet high, for the soldiers to stand upon. They are frequently made in the place of arms of the covert-way, at the salient angles, in the gorges, half-moons, and ravelins, &c.

TAMPIONS, } are wooden cylinders to put
TOMPIONS, } into the mouth of the guns, howitzers, and mortars, in travelling, to prevent the dust or wet getting in. They are fastened round the muzzle of the guns, &c. by leather collars.

They are sometimes used to put into the chambers of mortars, over the powder, when the chamber is not full.

TAMPIONS, in *sea service artillery*, are the iron bottoms, to which the grape-shot are fixed; the dimensions of which are as follow, viz.

42-pounders	-	$6\frac{6}{10}$ inches diameter
32 ditto	-	6
24 ditto	-	$5\frac{4}{10}$
18 ditto	-	$4\frac{9}{10}$
12 ditto	-	$4\frac{1}{10}$
9 ditto	-	$3\frac{1}{10}$
6 ditto	-	$6\frac{1}{4}$
4 ditto	-	$2\frac{9}{10}$
$1\frac{1}{2}$ ditto	-	$2\frac{1}{10}$
$\frac{1}{2}$ ditto	-	$1\frac{4}{10}$

TARGET, a sort of shield, being originally

made of leather, wrought out of the back of an ox's hide. They are much used by the Scotch.

TARGET, is also a mark for the artillery to fire at, in their practice.

TARPAULINGS, are made of strong canvass, thoroughly tarred, and cut into different sizes, according to their several uses in the field; such as to cover the powder-waggons, and tumbrils (carrying ammunition) from rain: each field-piece has likewise one to secure their ammunition-boxes.

TAP-TOO, }
TATT-TOO, } See DRUM.

TECHNICAL terms, are all terms of art, used in a military sense, &c.

TE DEUM, as far as it concerns *military matters*, is a holy hymn sung in thanksgiving for any victory obtained, and which is sometimes abused, by being sung by the vanquished enemy, to conceal their shame, &c.

TENABLE, in the *military art*, something that may be defended, kept, and held against assailants.

TENABLE, is little used, but with a negative. When a place is open on all sides, and its defences all beaten down, it is no longer tenable. When the enemy has gained such a height, this post is not tenable.

TENAILLES, in *fortification*, are low works, made in the ditch before the curtains: there are three sorts, viz. the first are the faces of the bastions produced, till they meet, but much lower; the second have faces, flanks, and a curtain; and the third have only faces and flanks.

Single TENAILLE, is a work whose front is advanced towards the country, having two faces, forming a re-entering angle: its two long sides terminate on the counterescarp, opposite to the angle of the shoulder.

Double TENAILLE, is a work, whose front having 4 faces, forms 2 re-entering, and 3 salient angles: its long sides are likewise parallel, and terminate on the counterescarp, opposite to the angle of the shoulder. Both the single and double tenailles have this fault, viz. that they are not flanked or defended at the re-entering angle, because the height of the parapet hinders the soldiers from discovering before that angle. Therefore tenailles should only be made, when there is not room enough to make horn-works. The ramparts, parapets, ditches, covert-way, and glacis of tenailles, are the same with other out-works.

TENAILLE of a place, is what is comprehended between the points of two neighbouring bastions;

bastions; as the faces, flanks, and curtain. Hence it is said, the enemy attacked the whole tenaille of a place, when they make two attacks on the faces of the two bastions.

TENAILLONS, are works made on each side of the ravelin, much like the lunettes: they differ, in that one of the faces of a tenailon is in the direction of the face of the ravelin; whereas that of the lunette is perpendicular to it.

TENTS, in *war*, a pavillion or portable house. They are made of canvass, for officers and soldiers to lie under when in the field.

The sizes of the officers tents are not fixed; some regiments have them of one size, and some of another: a captain's tent and marquée is generally 10½ feet broad, 14 deep, and 8 high: the subalterns are a foot less; the major's and lieutenant-colonel's, a foot larger; and the colonel's 2 feet larger.

The subalterns of foot lie two in a tent, and those of horse but one.

The tents of private men are 6½ feet square and 5 feet high, and hold 5 soldiers each.

The tents for the horse are 7 feet broad and 9 feet deep: they hold likewise 5 men, and their horse accoutrements.

Bell-TENTS, so called from their resemblance to a bell: they serve to shelter the fire-arms from rain.

To pitch the TENTS, is to fix them up ready for habitation, by the assistance of a ridge-pole, two standards, and a quantity of tent-pins.

TERRASS. See MORTAR.

TERRE *plein*, in *fortification*, the top platform, or horizontal surface of the rampart, whereon the cannon are placed, as well as the troops that defend the place: it is also the passage of the rounds.

TERTIAT, in *gunnery*, is to examine the thickness of the metal of a piece of artillery, in order to judge of its strength. This is usually done with a pair of calliper compasses.

TERTIATING, a piece of ordnance, is to find whether it has its due thickness at the vent, trunnions, and neck; if the trunnions and neck are in their due order, and the chase straight, &c.

TESTUDO, in the *military art of the ancients*, was a kind of cover or screen, which the soldiers of each company made themselves of their bucklers, by holding them up over their heads, and standing close to each other. This expedient served to shelter them from darts, stones, &c. thrown upon them, especially those from above, when they went to the assault.

TESTUDO, was also a kind of large wooden tower, which moved on several wheels, and

was covered with bullocks hides: it served to shelter the soldiers, when they approached the walls to mine them, or to batter them with rams.

TEUTONIC order. See ORDER.

THEORY, in *general*, denotes every doctrine which terminates in speculation alone, without considering the practical uses and application thereof. Military theory and practice joined are exceedingly useful.

THUNDERING-legion, was a legion in the Roman army, consisting of Christian soldiers; who, in the expedition of the emperor Marcus Aurelius against the Sarmatae, Quadi, and Marcomanni, saved the whole army, then ready to perish of thirst, by procuring, by their prayers, a very plentiful shower thereon, and at the same time a furious storm of hail, mixed with lightening and thunderbolts, on the enemy.

This is the account commonly given by ecclesiastical historians, and the whole history is engraven in bass-relievos on the Antonine column.

TILTS. See TOURNAMENTS.

TIMBER, in *military architecture*, includes all kinds of felled and seasoned wood used in the several parts of building, &c.

Oak, of all the different kinds of timber known in Europe for building, is the best in all respects; because, when it is well seasoned and dry, it is very tough and hard: it does not split so easily as other timber, and bears a much greater weight than any other. When it is used under cover, it never perishes, no more than in water; on the contrary, the older it grows, the harder it becomes; and when it is exposed to the weather, it exceeds all other timber for durability. English oak is the best, American the next, then Norway, and lastly German.

Elm, if felled between November and February, is all spine or heart, and no sap, and is of singular use in places where it is always wet or dry. It is very tough and pliable; it is easily worked, and does not easily split: it bears driving of bolts and nails into it better than any other wood; for which reason it is almost the only kind of wood used in artillery.

Beach, is likewise a very useful wood; it is very tough and white when young, and of great strength, but liable to warp very much when exposed to the weather, and to be worm-eaten when used within doors. It is frequently used for axle-trees, fellies, and all kind of wheel-wright work: but where it is kept constantly wet, and free from air, it will out-last oak.

Asb. Its use is almost universal, but it is rather scarce in most parts of Europe: it serves in buildings, or for any other uses where it is

skreened from the weather: hand-spikes and oars are chiefly made of it; and indeed it is the only wood that is fit for this, or any other purpose, which requires the wood to be tough and pliable.

Fir, commonly known by the name of *deal*, is of late much used in building, especially within doors. It wants but little seasoning, and is much stronger while the resinous particles are not exhausted, than when it is very dry: it will last long under water; and indeed some say it never perishes there.

Chestnut-tree, especially wild chestnut, is by many esteemed to be as good as oak, but is exceedingly rare.

There are many other kinds of wood, but not generally used in military works, consequently not mentioned here.

Preserving of TIMBER. When boards, &c. are dried, seasoned, and fixed in their places, care is to be taken to defend and preserve them; to which the linearing them with linseed oil, tar, or the like oleaginous matter, contributes much.

The Dutch preserve their gates, port-culices, draw-bridges, sluices, &c. by coating them over with a mixture of pitch and tar, whereon they strew small pieces of cockle and other shells, beaten almost to powder, and mixed with sea-sand, which incrusts and arms it wonderfully against assaults of wind and weather.

Seasoning of TIMBER. As soon as felled, it should be laid in some dry, airy place, but out of reach of too much wind or sun, even which, in excess, will subject it to crack and fly. It is not to be set upright, but laid along, one tree upon another, only with some short blocks between, to give it the better airing, and prevent it becoming mouldy, which will rot the surface and produce mushrooms on it. Some persons daub the trees all over with cow-dung, which occasions their drying equally, and prevents their cracking, as they are otherwise very apt to do.

Some recommend the burying timber in the earth, as the best method of seasoning it; and others have found it a fine preservative to bury their timber under the wheat in their granaries; but this cannot be made a general practice. In Norway, they season their deal planks, by laying them in salt water for 3 or 4 days, when new sawed, and then drying them in the sun: this is found a great advantage to them; but neither this, nor any thing else, can prevent their shrinking.

The seasoning timber is the best way of all, for piles and other pieces that are to stand under the earth, or water. The Venetians first found out this method; and the way they do it is this: they put the piece to be seasoned in a strong and violent flame, turning it continually round by means of an engine, taking it out when it is every where covered with a black coally crust: by this means the internal part of the wood is so hardened, that neither earth nor water can damage it for a long time after.

TIME, in *fencing*. There are three kinds of time, that of the sword, that of the foot, and that of the whole body. All the times that are perceived out of their measure, are only to be considered as appeals, or feints, to deceive and amuse the enemy.

TIME, in manœuvring, is that necessary interval betwixt each motion in the manual exercise, as well as in every movement the army or any body of men make.

TIN tubes. See TUBES, and LABORATORY.

TIRAILLEURS, in *the art of war*, are a kind of skirmishers, or marksmen, advanced in front to annoy the enemy, and draw off their attention; or they are left behind to amuse and stop their progress in the pursuit.

TIRE, are great guns, shot, shells, &c. placed in a regular form. See PILES.

TOMPION. See TAMPION.

TOISE, in *military mensuration*, is a French measure, containing 6 of their feet, or a fathom: a square toise is 36 square feet, and a cubical toise is 216 feet.

These two measures correspond in the division of the feet; but these divisions being unequal, it is necessary to observe, that the proportion of the yard, as fixed by the Royal Society at London, to the $\frac{1}{4}$ toise as fixed by the royal academy at Paris, is as 36 to 38.355.

TONGS, of a *waggon*, a piece of wood fixed between the middle of the hind ends of the shafts, mortised into the fore cross-bar, and let into the hind cross-bar.

TOOLS, used in *war*, are of many denominations and uses, as laboratory tools, mining tools, artificers tools, &c. which words see.

TOPOGRAPHY, in *military history*, a description or draught of some particular place, or small tract of land, as that of a fortification, city, manor or tenement, garden, house, castle, fort, or the like; such as engineers set out in their drawings, for the information of their prince or general.

TOURNAMENTS, or *Tournaments*, in *military antiquity*, a kind of martial sport, or exercise, which the ancient cavaliers used to perform, to show their bravery and address.

Tournaments had their origin from the ancient gladiatory combats, and not from the usage of the northerly people, as is commonly believed. In Cicero's time they were called by the Greek name *Anabatis*, because their helmet, in a great measure, obstructed their seeing.

TOWER bastions, in *fortification*, are small towers, made in the form of bastions, by M. Vauban, in his second and third method; with rooms or cellars underneath, to place men and guns in them.

Moveable TOWERS, in *ancient military history*, were three story high, built with large beams. Each tower was placed on 4 wheels or trucks, and towards the town covered with boiled leather, to guard it from fire, and to resist the darts: on each story 100 archers were posted. They were pushed by the force of men to the city wall. From these the soldiers, placed in the different stages, made such vigorous discharges, that none of the garrison dared to show themselves on the rampart.

TOWN-adjutant, is an assistant to the town-major. See **ADJUTANT**.

TOWN-major, is an officer constantly employed about the governor or officer commanding a garrison, &c. He issues their orders to the troops, and reads its common orders to fresh troops when they arrive. He commands according to the rank he had in the army; but if he never had any other commission than that of town or fort-major, he is to command as youngest captain. See **MAJOR**.

TRAIL, in *gunnery*, is the end of a travelling-carriage, opposite to the wheels, and upon which the carriage slides, when unlimbered, or upon the battery. See **CARRIAGE**.

TRAIN, in *war*, the attendance of a prince, or general, upon many occasions.

TRAIN, is also used for a line of gun-powder, laid to give fire to a quantity thereof, in order to do execution by blowing up earth, works, buildings, &c.

TRAIN of artillery, in a *general sense*, means the regiment of artillery; it also includes the great guns, and other pieces of ordnance belonging to an army in the field. See **ARTILLERY**.

TRAIN-bands, or *trained-bands*, a name given to the militia of England.

TRANSOMS, in *artillery*, are pieces of wood which join the cheeks of gun-carriages: there

is but one in a truck-carriage, placed under the trunnion-holes; and four in the wheel-carriages, the trail, the centre, the bed, and the breast-transoms. See **CARRIAGE**.

TRANSOM-plates, with hooks. There is one on each side of the side-pieces, against each end of the transom, the bed-transom excepted, fastened by two transom-bolts. See **IRON-WORK OF FIELD CARRIAGES**.

TRANSOM-bolt, with bars. They serve to tie the side-pieces to the transoms. See **IRON-WORK OF FIELD CARRIAGES**.

TRAVELLING { *carriages*. See **CARRIAGE**.
 { *forge*. See **FORGE**.

TRAVERSE, in *fortification*, is a parapet made cross the covert-way, opposite to the salient angles of the works, and near the places of arms, to prevent entilades. They are 18 feet thick, and as high as the ridge of the glacis. There are also traverses made in the caponiers; but then they are called *tambours*.

TRAVERSES, are likewise made within other works, when there are many hills and rising grounds which may see the inside of these works. They are also made in the saps, &c. See **FORTIFICATION**.

To TRAVERSE a gun or mortar, is to bring her about to the right or left with hand-spikes, 'till she is pointed exactly to the object.

TRAVERSING-plates, in *gun-carriages*, are two thin iron plates, nailed on the hind part of a truck carriage of guns, where the hand-spike is used to traverse the gun. See **CARRIAGE**.

TREMOINS, a term for pieces of earth left standing, as marks, in the ditches of a fortification they are emptying, to know exactly how many cubical fathoms, or feet of earth, have been carried away; and thereby the workmen are paid.

TRENCHES, in a *siege*, are ditches made by the besiegers, that they may approach more securely to the place attacked; whence they are also called *lines of approach*. The tail of the trench is the place where it was begun, and its head is the place where it ends.

The *trenches* are usually opened or begun in the night-time; sometimes within musket-shot, and sometimes within half or whole cannon-shot, of the place; generally about 800 toises. They are carried on in winding lines, nearly parallel to the works, so as not to be in view of the enemy, nor exposed to the enemy's shot.

The workmen employed in the *trenches* are always supported by a number of troops.

send them against the sallies of the besieged. The pioneers, and other workmen, sometimes work on their knees, and are usually covered with mantlets or saucissons; and the troops who support them lie flat on their faces, in order to avoid the enemy's shot. On the angles or sides of the trench, there are lodgements, or epaulements, in form of traverses, the better to hinder the sallies of the garrison, and to favour the advancement of the trenches, and to sustain the workmen.

The platforms for the batteries are made behind the trenches; the first at a good distance, to be used only against the sallies of the garrison. As the approaches advance, the batteries are brought nearer, to ruin the defences of the place, and dismount the artillery of the besieged. The breach batteries are made when the trenches are advanced near the covert-way.

If two attacks, there must be lines of communication, or boyaus, between the two, with places of arms at convenient distances. The trenches are 6 or 7 feet high with the parapet, which is 5 feet thick, with banquettes for the soldiers to mount upon.

Returns of a TRENCH, are the elbows and turnings, which form the lines of approach, and made, as near as can be, parallel to the place, to prevent their being enfiladed.

To mount the TRENCHES, is to mount guard in the trenches, which is generally done in the night.

To relieve the TRENCHES, is to relieve the guard of the trenches.

To secur the TRENCHES, is to make a vigorous sally upon the guard of the trenches, force them to give way, and quit their ground, drive away the workmen, break down the parapet, fill up the trench, and nail their cannon.

Counter-TRENCHES, are trenches made against the besiegers; which consequently have their parapet turned against the enemy's approaches, and are enfiladed from several parts of the place, on purpose to render them useless to the enemy, if they should chance to become masters of them; but they should not be enfiladed, or commanded by any height in the enemy's possession.

To open the TRENCHES, is the first breaking of ground by the besiegers, to carry on their approaches towards the place. See SIEGE.

TRIANGLE, in *geometry*, is a figure of three sides, and three angles, and either plane or spherical.

Plane TRIANGLE, is that contained under three right lines,

Right-angled TRIANGLE, is that which hath one right angle.

Obtuse-angled TRIANGLE, is such as hath one obtuse angle.

Acute-angled TRIANGLE, is that which hath all its angles acute.

Equilateral TRIANGLE, is that which hath all its sides equal to one another, as likewise its angles equal to 60 degrees each.

Isoceles TRIANGLE, is that which hath only two sides equal.

Scalenous TRIANGLE, is that which hath no two sides equal. In every triangle, the sum of all the three angles is equal to two right ones; and the external angle, made by any side produced, is equal to the sum of the internal and its opposite one.

In every triangle, as well plane as spherical, the sines of the sides are proportional to the sines of the opposite angles.

TRIARI, in the *Roman militia*, a kind of infantry, armed with a pike, a shield, a helmet, and a cuirass; thus called, because they made the third line of the battle.

TRIBUNE, an officer in the Roman army, who commanded in chief over a body of forces, particularly the division of a legion, much the same with our colonel, or the French *maître-de-camp*.

TRIUMPH, a solemnity practised by the ancient Romans, to do honour to a victorious general.

There were two sorts of *triumphs*, the greater and the lesser, particularly called *ovation*: of these, the *triumph* was by much the more splendid procession. None were capable of this honour but the dictator, consuls, and pretors; though there are examples to the contrary, as particularly in Pompey the Great, who had a *triumph* decreed him when he was only a Roman knight, and had not yet reached the senatorial age.

The *triumph* was the most pompous show among the ancients: authors usually attribute its invention to Bacchus, and tell us, that he first triumphed upon the conquest of the Indies; and yet this ceremony was only in use among the Romans. The Grecians had a custom which resembled the Roman *triumph*; for the conquerors used to make a procession through the middle of their city, crowned with garlands, repeating hymns and songs, and brandishing their spears: their captives were also led by them, and all their spoils exposed to public view. The order of a Roman *triumph* was chiefly thus: The senate having decreed the general a *triumph*, and appointed a day, they went

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went out of the city gate to meet the conqueror, and marched in order with him through the city. The cavalcade was led up by the musicians, who had crowns on their heads; and after them came several chariots with plans and maps of the cities and countries subdued, done in relieve: they were followed by the spoils taken from the enemy, their horses, arms, gold, silver, machines, tents, &c. After these came the kings, princes, or generals subdued, loaden with chains, and followed by mimics or buffoons, who exulted over their misfortunes. Next came the officers of the conquering troops, with crowns on their heads. Then appeared the triumphal chariot, in which was the conqueror richly clad in a purple robe, embroidered with gold, setting forth his glorious achievements. His buskins were beset with pearl; and he wore a crown, which at first was only laurel, but afterwards gold: one hand held a laurel-branch, the other a truncheon. At his feet were his children, or sometimes on the chariot-horses. As the triumphal chariot passed along, they strewed flowers before it. The music played in praise of the conqueror, amidst the loud acclamations of the people, crying, *To triumph!* The chariot was followed by the senate, clad in white robes, and the senate by such citizens as had been set at liberty, or ransomed. The procession was closed by the sacrifices, and their officers and utensils, with a white ox led along for the chief victim. In the mean time all the temples were open, and altars loaded with offerings and incense; games and combats were celebrated in the public places, and rejoicings appeared every where.

TROOP of *horse*, or *dragons*, is a small body of about 50 or 60, commanded by a captain, captain-lieutenant, cornet, quarter-master, and 3 or 4 corporals, who are the lowest officers in a troop.

TROOPER, a private man in a troop of horse.

TROOP, a certain beat of the drum. See **DRUM**.

TROPHY, among the ancients, a pile or heap of arms of a vanquished enemy, raised by the conqueror in the most eminent part of the field of battle.

The *trophies* were usually dedicated to some of the Gods, especially Jupiter. The name of the deity, to whom they were inscribed, was generally mentioned, as was that also of the conqueror. The spoils were at first hung upon the trunk of a tree; but instead of trees, suc-

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ceeding ages erected pillars of stone, or brass, to continue the memory of their victories. To demolish a *trophy* was looked upon as a sacrilege, because they were all consecrated to some deity.

TROPHY-money, denotes certain money annually raised in the several counties of the kingdom, towards providing harness, and maintaining the militia.

TROUS-DE-LOUP, in *field fortification*, are round holes, about 6 feet deep, and pointed at the bottom, with a stake placed in the middle. They are frequently dug round a redout, to obstruct the enemy's approach. They are circular at top, of about $4\frac{1}{2}$ feet diameter.

TRUCE, in the *art of war*, denotes a suspension of arms, or a cessation of hostilities, between two armies, in order to settle articles of peace, bury the dead, or the like.

TRUCKS of a *ship-carriage*, are wheels made of one piece of wood, from 12 to 19 inches diameter, and their thickness is always equal to the caliber of the gun.

The **TRUCKS** of *garrison-carriages* are made of cast-iron.

TRUCK-carriage, goes upon 4 trucks of 24 inches diameter, has two flat side-pieces, of 10 inches broad, and serves to carry guns, ammunition-boxes, or any other weights, from the store-houses to the water side, or to any small distance.

TRUMPET, made of brass or silver, with a mouth-piece to take out and put in at pleasure. Each troop of cavalry has one.

The first sound of a trumpet before a march, is when the drums beat a *general*, at which the troopers boot, saddle, and get ready. When the *assembly* begins to beat, the trumpet sounds *to horse*; on which the troopers mount, and, at the third sound, march. The trumpet likewise sounds a charge in the day of battle, and the retreat at night, &c. The cords of the trumpets are of crimson, mixed with the colours of the facings of the regiments. The king's own regiment of dragoons, and the royal Irish, are permitted to continue their kettle-drums; to which they are to have banners of the same dimensions as those which are ordered for the regiments of horse.

TRUNCHEON, in *military affairs*, a staff of command, borne by a general officer. It likewise implies a club, or cudgel.

TRUNCHEONEER, is one armed with a truncheon.

TRUNNIONS, in *guns*, two cylindric pieces of metal in a gun, mortar, or howitzer, which project

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project the piece, and by which they are supported upon their carriages. See CANNON.

TRUNNION-plates, are two plates in travelling carriages, mortars, and howitzers, which cover the upper parts of the side-pieces, and go

under the trunnions; its fore part ends with a flat rose. See CARRIAGE.

TRUSS of forage, is as much as a trooper can carry on his horse's crupper. See SPUN-HAY.

Dimensions of Tin TUBES for all the different sorts of artillery.

Natures	Length			Length			Diameters		
	Heavy	Mediums	Light	Sea mortars	Land mortars	Howitzers	Cap at top	Cap at bottom	Spindle
42 pdrs.	inches 9.7	inches	inches	inches	inches	inches	inches .9	inches .15	inches .2
32 ditto	9.7						.9	.15	.2
24 ditto	8.9	8.3	6.5				.9	.15	.2
18 ditto	8.						.9	.15	.2
12 ditto	7.3	7.3	5.7				.9	.15	.2
9 ditto	6.8	6.8					.9	.15	.2
6 & 4 ditto	6.5	5.7	4.7				.9	.15	.2
3 ditto	5.9		4.2				.9	.15	.2
1½ ditto	4.2						.9	.15	.2
13 in. S. M.				12.			1.2	.12	.2
10 in. S. M.				7.7½			1.	.13	.2
10 in. L. M.					5.7		1.	.13	.2
8 in. L. M.					4.7		.9	.15	.2
5½ royal cohorn					4.2		.8	.15	.2
4½ royal cohorn						6.5	.9	.15	.2
8 in. H.						5.7	.8	.15	.2
5½ in. H.						4.2	.8	.15	.2
4½ in. H.						3.6	.8	.15	.2

N. B. S. M. stands for sea-service mortar, L. M. for land-service mortar, and H. for howitzer.

T U G

TUGPINS, are the iron pins which pass through the fore ends of the shafts of the army carts, to fasten the draught-chains for the fore-horses.

TUMBRELS, are a kind of carriages with two wheels only: they are used to carry the pioneers, miners, and artificers tools: sometimes they are used to carry the money of the army.

TURNAMENT, or *tournament*, a martial

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sport, or exercise, which the ancient cavaliers used to perform to show their bravery and address. They were first instituted in the year 934; but they made not their appearance in England 'till the reign of king Stephen, anno 1138.

TURNPIKE, in the *military art*, a kind of beam, stuck full of spikes, to be placed in a defile, breach, or at the entrance of a camp, &c. to keep off an enemy.

V U

VALOUR, in the *army*, is a generous character, which, far from assuming brutality and violence, with-holds the fury of the soldier, protects helpless women, innocent infants, and white old-age. No thing which is incapable of resistance can ever be the object whereon true valour may exercise its prowess. Courage is that grandeur of soul which prompts us to sacrifice all personal advantages, and even the preservation of our beings, to a love of doing our duty. The exercise of this determined courage in the profession of arms is called *valour*. It is composed of bravery, reason, and force: by *bravery* we understand that lively ardour which fires us for the combat; *reason* points out to us the method of conducting it with justice and prudence; and *force* is necessary for the execution. It is bravery which animates the heart, reason springs from the soul, and force depends upon the body: without bravery we fear obstacles, danger, and death; without reason courage would have no legitimate view; and without force it would be useless: these three qualities should concur to form true military valour.

VAN, the front of an army.

VAN-guard, that part of the army which marches in the front. See **GUARD**.

VEDETTE, in *war*, a sentinel on horse-back, with his horse's head towards the place whence any danger is to be feared, and his carbine advanced, with the butt-end against his right thigh. When the enemy has encamped, there are vedettes posted at all the avenues, and on all the rising grounds, to watch for its security.

The *vedettes* to the out-posts should always be double, for the following reasons: First, that whenever they make any discovery, one may be detached to the commanding officer of the out-posts; secondly, that they may keep each other watchful; and thirdly, that the vigilance of both may render it impossible for any thing to come

near them without being seen. They should be at no greater distance from their detachment, than 80 or 100 paces.

VELOCITY. See **GUNNERY**, **MOTION**, and **PROJECTILES**.

VENT, in *artillery*, or, as it is vulgarly called, the *touch-hole*, is the opening through which the fire is conveyed to the powder which composes the charge.

As the placing the *vents* in mortars, howitzers, and guns, in the best manner, is so very delicate a point, and about which both authors and practitioners differ, we will advance what the result of experiments has demonstrated. The most common method is to place the *vent* about $\frac{1}{4}$ of an inch from the bottom of the chamber, or bore; though we have seen many $\frac{1}{2}$ an inch, and some an inch from the bottom. It has always been imagined, that if the *vent* was to come out in the middle of the charge, the powder would be inflamed in less time than in any other case, consequently produce the greatest range; because, if a tube be filled with powder, and lighted in the centre, the powder would be burnt in half the time it would be if lighted at one end. This gave a grounded supposition, that the greater quantity of powder burnt before the shot or shell was sensibly moved from its place, the greater force it would receive. To determine this, the king of Prussia, in 1765, ordered, that a light 3-pounder should be cast with three shifting *vents*, one at the centre of the charge, one at the bottom, and the other at an equal distance from the bottom and centre one; so that when one was used, the others were effectually stopped. The gun weighed 2C. 1qr. 20lb. its length was 3 feet 3 inches, and the bottom of the bore quite flat. It was loaded each time with $\frac{1}{4}$ of the shot's weight; when it was found, that when the lowest or bottom *vent* was used, the shot went farthest, and the ranges of the others diminished in proportion as they were distant from the bottom.

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The piece was elevated to 1 degree 30 minutes. In 1766, the same monarch had three small mortars made of equal size and dimensions: their bores were 4.6 inches, and 73.5 inches long; one had a cylindric chamber of 1.6 inches diameter, and 3.7 inches long; the other a concave chamber, the entrance of which was 1 inch diameter; the third a conic chamber, whose greatest diameter was 2.7 inches, and the least 1.4. Each of these chambers held $7\frac{1}{2}$ ounces of powder; they had each two vents, one at the bottom of the chamber, and the other at the centre. Each mortar weighed about 89 pounds, and the shell, when filled, 7 pounds; and the following experiments were tried. The ranges are in feet.

Experiments to find the proper place for VENTS, and the best figure for chambers; by order of his majesty the king of Prussia.

Powd. Ounces	Elevat. °	Place of vents.	Conic cham.	Cyl. cham.	Concave cham.	Remarks
5	30	middle	1890	1936	2290	Com pow. Cool day
5	35	ditto	1974	1998	2374	ditto ditto
5	45	ditto	2892	3031	3176	ditto ditto
5	45	ditto	2746	3018	3158	ditto ditto
5	30	bottom	2218	2400	2563	ditto, warm & windy
5	35	ditto	2357	2590	2730	ditto ditto
5	45	ditto	2980	3147	3267	ditto ditto
5	45	ditto	2843	3139	3281	ditto ditto
$7\frac{1}{2}$	45	middle	3263	3521	3698	ditto, cool & calm
$7\frac{1}{2}$	45	ditto	3228	3524	3702	ditto ditto
$7\frac{1}{2}$	45	ditto	3196	3516	3708	ditto ditto
$7\frac{1}{2}$	43	ditto	3276	3602	3824	ditto, warm & calm
$7\frac{1}{2}$	43	ditto	3209	3598	3796	ditto ditto
$7\frac{1}{2}$	44	bottom	3198	3567	3818	ditto ditto
$7\frac{1}{2}$	44	ditto	3201	3603	3823	ditto ditto
$7\frac{1}{2}$	43	ditto	3186	3579	3784	ditto ditto
$7\frac{1}{2}$	43	ditto	3214	3547	3748	ditto ditto

N. B. By this table it appears, that the concave chamber produced the greatest ranges, and that the bottom of the chamber is the best place for vents, having in that place the greatest effect. Each range was the medium of 12 rounds.

VENT-field, is the part of a gun or howitz between the breech-mouldings and the astragal.

VENT-astragal, that part of a gun, or howitzer, which determines the vent-field.

VETERAN, in the *Roman militia*, a soldier who was grown old in the service, or who had made a certain number of campaigns, and on that account was intitled to certain benefits and privileges.

Twenty years service were sufficient to intitle

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a man to the benefit of a veteran. These privileges consisted in being absolved from the military oath, in being exempted from all the functions of a soldier, in enjoying a certain salary or appointment, &c.

VIBRATION. See **PENDULUM**.

VICTORY, the overthrow or defeat of an enemy, in war, combat, duel, or the like.

VICTUALS, or regulations for victualling the royal regiment of artillery, and other troops on board of the transports; with the method of classing the men, women, and children, into messes.

As soon as the troops are embarked, the quarter-master immediately divides them into messes, allowing 4 or 6 to each mess; that is, 1 man, 1 woman, and 3 children under 10 years of age, being equal to a mess of 4 men. Children at 10 years of age are accounted men or women.

When the messes are completed, and every one classed to their births, the quarter-master gives the steward of the transport a return of the number thereof; upon the receipt of which he immediately issues out bedding and utensils at the following rate.

To each birth, 1 flock bed, 1 bolster, 2 blankets, and 1 rug.

To each mess, 2 bowls, 4 spoons, 1 can, and 1 pudding-bag.—N. B. Three men are generally appointed to 1 birth.

The following table gives the daily allowance of provisions of each species per man.

Days	Biscuit	Beef	Pork	Peas	Oatmeal	Butter	Cheese	Beer	Vinegar
	lb.	lb.	lb.	pints	pints	oz.	oz.	gal.	pints
Sunday	1	0	1	$\frac{1}{2}$	0	0	0	1	0
Monday	1	0	0	0	1	2	4	1	0
Tuesday	1	2	0	0	0	0	0	1	0
Wednesday	1	0	0	$\frac{1}{2}$	1	2	4	1	0
Thursday	1	0	1	$\frac{1}{2}$	0	0	0	1	0
Friday	1	0	0	$\frac{1}{2}$	1	2	4	1	0
Saturday	1	2	0	0	0	0	0	1	$\frac{1}{2}$

N. B. The weights are averdupois, and the pints Winchester measure.

When

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When any alterations from the above take place, it is in the following manner: A pint of wine, half a pint of brandy, rum, or arrack, are equal to a gallon of beer; 4 pounds of flour, or 3 pounds of the same, with a pound of fruit, raisins, or $\frac{1}{2}$ a pound of currants, or $\frac{1}{4}$ a pound of pickled beef suet, are equal to 4 pounds of beef, or 2 pounds of pork with peas; $\frac{1}{2}$ a pound of rice is equal to 1 pound of oatmeal; a pint of olive oil is equal to 1 pound of butter, or 2 pounds of Suffolk cheese; and $\frac{3}{4}$ of a pound of Cheshire cheese, is equal to 1 pound of Suffolk cheese. Beef provided for his majesty's ships, is to be cut into 4-pound pieces, and the pork into 2-pound pieces; and no unusual

pieces are to be put up, such as legs, bones, shins of oxen, cheeks of hogs, ox-hearts, &c.

If it should happen that the pork runs short, the captain is to order the purser to issue 3 pounds of beef for 2 pounds of pork.

For the better preservation of the men's health, it is ordered that one day in the week, there shall be issued out to them a proportion of flour and suet in lieu of beef; also a proportion of canvass for pudding-bags, after the rate of 1 ell to every 16 men.

In foreign voyages, there shall only be supplied 3 months butter and cheese; the remainder of those species to be made up in olive oil.

TABLE of the allowance of provisions served out at the different forts, garrisons, and ports, in North-America, to his majesty's troops; they paying at the rate of 2½d. per day, or per ration.

7 days in all species				7 days in any one species				1 day in any one species			
Species	lb.	oz.	pints	Species	lb.	oz.	pts.	Species	lb.	oz.	pts.
Flour	7			Flour	21			Flour	3		
Fresh beef	7			Pork	9	3		Pork	1	5	
Butter		6		Butter	5	4		Butter		12	
Pork in lieu of beef	4			Peas			28	Peas			4
Peas			3	Rice			10½	Rice			1½
Rice			$\frac{1}{2}$								

N. B. The pork, butter, peas, and rice, are in lieu of the 7 lb. of beef.

VIEW of a place, to besiege it, is said to be taken when the general, accompanied by an engineer, reconnoitres it; that is, rides round the place, observing its situation, with the nature of the country about it; as hills, valleys, rivers, marshes, woods, hedges, &c. thence to judge of the most convenient place for opening the trenchés, and carrying on the approaches; to find out proper places for encamping the army, and for the park of artillery.

To VIEW. See *To RECONNOITRE*.

VOLLEY, is a military salute, made by the discharging of a great number of fire-arms at the same time.

VOLUNTEERS, persons who, of their own accord, either for the service of their prince, or out of the esteem they have for their general, serve in the army without being in-

listed, to gain honour and preferment, by exposing themselves in the service.

UHLANS, are Uckranian soldiers, chiefly Mahometans. In person, dress, and manner of fighting, they resemble the Tartars, Calmucks, &c. They are armed with pistols, sabres, a lance 15 feet long, and sometimes use a bow and arrow instead of a carbine.

UNDECAGON, is a regular polygon of 11 sides.

UNIFORM. See **REGIMENTALS**.

UTENSILS, in a *military sense*, are necessities due to every soldier, and to be furnished by his host, where he is in quarters, viz. bed, with sheets, a pot, a glass or cup to drink out of, a dish, a place at the fire, and a candle. See **BILLETING**.

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W A D

WAD, in *gunnery*, made of hay or straw, and sometimes of tow rolled up tight in a ball, serves to be put into a gun after the powder, and rammed home, to prevent the powder from being scattered, which would have no effect when unconfined.

WAD-mill, a hollow form of wood to make the wads of a proper size.

WAD-book, a strong iron screw, like those that serve for drawing corks, mounted upon a wooden handle, to draw out the wad, or any parts of cartridges, which often remain in guns, and when accumulated stop up the vent.

WADDING, hay or straw, or any other forage, generally carried along with the guns to be made into wads.

WAGGON, in *the army*, is a four-wheel carriage, drawn by 4 horses, and for sundry uses.

Ammunition-WAGGON, is for transporting all kinds of stores, as also to carry bread, it being lined round in the inside with basket-work.

WARNING-piece. See **EVENING-GUN**, at the word **GUN**.

WAR, a contest or difference between princes, states, or large bodies of people, which, not being determinable by the ordinary measures of justice and equity, is referred to the decision of the sword.

It is that important event for which all military education is designed to prepare the soldier. It is for this that in peace he receives the indulgence of a subsistence from society; and for this he is gratefully bound to secure the repose of that society from the outrage of barbarians, and to guard its possessions from the devastations of banditti.

Though it would be equally needless, as impossible, to show how often this art of the soldier has accomplished the design of its institution; we shall however distinguish those wars which are remarkable for having obtained the blessings of peace to this kingdom since the

War with Scotland, 1068.

Peace with { ditto, 1113.
France, 1113.

War with France, 1116.

Peace with { ditto, 1118.
Scotland, 1139.

War with France, 1161.

Peace with ditto, 1186.

W A R

War again with France, with success, 1194.

Peace with ditto, 1195.

Civil war { renewed, 1215.
ended, 1216.
with France, 1224.
ended, 1243.

1262.
ended, 1267.
with France, 1294.
with Scotland, 1296.

Peace { with France, 1299.
with Scotland, 1323.

War { again with Scotland, 1327.
ended, 1328.
again with Scotland, 1333.
with France, 1339.

Peace with France, May 8, 1360.

War { with France, 1368.
civil, 1400.
with Scotland, 1400.

Peace with France, May 31, 1420.

War { with France, 1422.
civil between York and Lancaster,
1452.

Peace with France, Oct. 1471.

War { civil, 1486.
with France, Oct. 6, 1492.

Peace { with ditto, Nov. 3, 1492.
with Scotland, 1502.

War { with France, Feb. 4, 1512.
with Scotland, 1513.

Peace with France, Aug. 7, 1514.

War with { ditto, 1522.
Scotland, 1522.

Peace with { France, 1527.
Scotland, 1542.

War with Scotland, directly after.

Peace with France and Scotland, June 7, 1546.

War with { Scotland, 1547.
France, 1549.

Peace with both, March 6, 1550.

War { civil, 1553.
with France, June 7, 1557.
with Scotland, 1557.

Peace with { France, April 2, 1559,
Scotland, 1560.

War { 1562.
Peace } with France { 1564.

War with { Scotland, 1570.
Spain, 1588.

Peace

W A R

- Peace with ditto, Aug. 18, 1604.
- War with { Spain, 1624.
France, 1627.
- Peace with Spain and France, April 14, 1629.
- War { civil, 1642.
with the Dutch, 1651.
- Peace with ditto, April 5, 1654.
- War with Spain, 1655.
- Peace with Spain, Sept. 10, 1660.
- War with { France, Jan. 26, 1666.
Denmark, Oct. 19, 1666.
- Peace with the French, Danes, and Dutch, Aug. 24, 1667.
- Peace with Spain, Feb. 13, 1668.
- War with the Algerines, Sept. 6, 1669.
- Peace with ditto, Nov. 19, 1671.
- War with the Dutch, March, 1672.
- Peace with ditto, Feb. 28, 1674.
- War with France, May 7, 1689.
- Peace, general, Sept. 20, 1697.
- War with France, May 4, 1702.
- Peace of Utrecht, Mar. 13, 1713.
- War with Spain, Dec. 1718.
- Peace with ditto, 1721.
- War with { Spain, 1739.
France, March 31, 1744.
- Peace with France, &c. 1748.
- War with { France, 1756.
Spain, Jan. 4, 1762.
- Peace with France and Spain, Feb. 10, 1763.

There are five different kinds of war, each of which is to be conducted differently the one from the other, viz. the *offensive*; the *defensive*; that between *equal powers*; the *auxiliary*, which is carried on out of our own territories, to succour a prince, or ally, or to assist a weaker, whom a more powerful prince has attacked; and the *civil war*.

Offensive WAR, must be long meditated on in private, before it breaks out: when it does, the success will depend upon two essential points; that the plan be justly formed, and the enterprises conducted with order. It should be well and maturely considered and digested, and with the greatest secrecy, lest, however able the prince or his council may be, some of the precautions necessary to be taken may be discovered. These precautions are infinite both at home and abroad.

Abroad, they consist in alliances, and security not to be disturbed in the meditated expedition; foreign levies, and the buying up of warlike ammunition, as well to increase your own stores as to prevent the enemy getting it.

W A R

The precautions at home consist in providing for the security of our distant frontiers, levying new troops, or augmenting the old ones, with as little noise as possible; furnishing your magazines with ammunition; constructing carriages for artillery and provisions; buying up horses, which as much as possible should be done among your neighbours, both to prevent their furnishing the enemy, and to preserve your own for the cavalry and the particular equipages of the officers.

Defensive WAR, may be divided into three kinds. It is either a war sustained by a prince suddenly attacked by another, superior to him in troops, and in means; or a prince makes this sort of war by choice on one side of his frontiers, while he carries on an offensive war elsewhere; or it is a war become defensive by the loss of a battle.

A *defensive war* which a prince, attacked by a superior enemy, sustains, depends entirely on the capacity of his general. His particular application should be, to chuse advantageous camps, proper to stop the enemy, without however being obliged to fight them; to multiply small advantages; to hem in the enemy in their forages, and to oblige them to do it with great escorts; to attack their convoys; to render the passages of rivers or defiles as difficult to them as possible; to force them to keep together: if they want to attack a town, to throw in succours before it is invested: in short, in the beginning, his chief aim should be, to acquire the enemy's respect by his vigilance and activity, and by forcing him to be circumspect in his marches and manner of encampment, in order to gain time himself, and make the enemy lose it. An able general, carefully pursuing these maxims, will give courage to his soldiers, and to the inhabitants of the country: he gives time to his prince, to take proper precautions to resist the enemy who attacks him, and thus changes the nature of this war, always disagreeable for him who is reduced to it.

To conduct a *defensive war* requires more military judgement than that of an offensive one.

A *WAR betwixt equal powers*, is that in which the neighbouring princes take no part, so long as the belligerent powers obtain no great advantage the one over the other. This sort of war never should last long, if you want to reap any advantages from it. As to its rules, they are intirely conformable to those already given; but we may look on it as a certain maxim in this.

this sort of war, that the general the most active and penetrating will ever in the end prevail over him who possesses these qualities in a lesser degree; because, by his activity and penetration, he will multiply small advantages, 'till at last they procure him a decisive one. A general, continually attentive to procure himself small advantages, ever obtains his end, which is to ruin the enemy's army; in which case he changes the nature of the war, and makes it offensive, which should ever be the chief object of his prince.

Auxiliary WAR, is that in which a prince succours his neighbours, either in consequence of alliances or engagements entered into with them, or sometimes to prevent their falling under the power of an ambitious prince.

If it is in virtue of treaties, he observes them religiously, in furnishing the number of troops prescribed, and even offering to augment it, if required; or by making a diversion by attacking the common enemy, or his allies.

If it is to prevent a neighbouring prince from being crushed by a power, who after this conquest may become dangerous to yourself, there are several measures to be taken for your own particular interest. One of the chief is, to exact from those you succour, the possession of some place, in security, lest they make their peace without your knowledge, or to your prejudice.

The general therefore chosen for the command of this auxiliary corps, should have wisdom, penetration, and foresight; wisdom, to preserve a proper discipline in his corps, that the allied prince may have no cause to complain of him; foresight and penetration, to prevent his troops suffering for want of subsistence, or being exposed to the perils of war, but in proportion to their numbers with those of the allied prince; and, finally, that nothing shall pass without his knowledge, which may be prejudicial to his master.

Civil or intestine WAR, is that between subjects of the same realm, or between parties in the same state. In this sense, we say, the civil wars of the Romans destroyed the republic; the civil wars of Grenada ruined the power of the Moors in Spain; the civil wars in England, begun 1641, ended in the king's death.

Religious WAR, is war maintained in a state on account of religion, one of the parties refusing to tolerate the other.

Holy WAR, is that anciently maintained by leagues and croisades, for the recovery of the Holy Land.

Civil and Religious WARS, are ever unhappy for the states who sustain them. These sorts of war, which the animosity of the different parties, and fanaticism, always carry beyond the bounds of humanity, and the duties of society, have in general no other rules but those of the *offensive* and *defensive*. It has however always been observed, that *civil wars* form great men and good soldiers; because the nobility, citizens, and labourers, being equally obliged to fight for their property and preservation, have all an opportunity of learning the art of war.

Council of WAR, is an assembly of great officers, called by a general, or commander, to deliberate with him on enterprises and attempts to be made. On some occasions, *council of war* is also understood of an assembly of officers, sitting in judgement on delinquent soldiers, deserters, coward officers, &c.

WARASDINS, a kind of Slavonian soldiers, clothed like the Turks, with a sugar-loaf bonnet instead of a hat. Their arms are a fuzée and pistols; the butt end of their fuzée serves for a spade, when they have occasion to throw up earth.

WAR-CRY, was formerly customary in the armies of most nations, when just upon the point of engaging. Sometimes they were only tumultuous shouts, or horrid yells, uttered with an intent to strike terror into their adversaries; such as is now used by the Indians in America, called the *war-whoop*.

WARREN, at Woolwich, is the head-quarters for the royal artillery, the royal foundry, royal laboratory, and royal military academy; also famous for proofs and experiments of artillery, and great apparatus of war.

WARWOLF, in *ancient military history*, an engine for throwing stones, and other great masses.

WASHERS, a flat circular ring put on the axle-tree, between the linch-pin and small end of the nave, to prevent the nave rubbing against the linch-pin and wearing it, as likewise to diminish the friction of the nave.

WAY of the rounds, in *fortification*, is a space left for the passage of the rounds, between the rampart and the wall of a fortified town. This is not much in use at present.

WEDGE. See COINS.

WEIGHTS, in *military matters*, are those in general use, except in artillery, where hundreds are made use of, each of 112 lb. quarters; each of 28 lb. and pounds, which are averdupois.

W E L

The 100lb. of England, Scotland, and Ireland, are equal to

91 lb. 8 oz.		(Amsterdam, Paris, &c.
96	8	Antwerp or Brabant;
88	0	Rouen, the viscounty weight
106	0	Lyons, the city weight;
91	8	Paris;
90	9	Rochelle;
107	11	Toulouse & Up. Languedoc;
113	0	Marfeilles or Provence;
81	7	Geneva;
93	5	Hamburgh;
89	7	Frankfort, &c.;
137	4	} of Genoa;
132	11	
153	11	
152	0	
154	10	
97	0	
104	13	
112	8	
96	5	
112	$\frac{1}{2}$	
107	$\frac{1}{2}$	} of Leghorn;
89	$\frac{1}{2}$	
		Milan;
		Venice;
		Naples;
		Seville, Cadiz, &c.
		Portugal;
		Spain;
		Liege;
		Russia;
		Sweden;
		Denmark.

WELL, in the *military art*, a depth which the miner sinks under ground, with branches or galleries running out from it; either to prepare a mine, or to discover and disappoint the enemy's mine. See **SHAFT**.

WHEEL, in *artillery*. Their strength is always, or should be, proportional to the weight they carry: the diameters of the wheels of heavy gun-carriages are 85 inches, and those for light field-pieces 52 only. See **CARRIAGE**.

To WHEEL, a motion that brings any body of men to front on that side where the flank was, which is wheeling to the right or left. If a battalion wheels to the right, the left wing moves first, describing the 4th part of a circle about the file-leader on the right, who is the centre of the motion: if the wheeling is to the left, the contrary is performed.

WHEELINGS, are different motions made both by horse and foot, either to the right or left, or to the right and left about, &c.

General rules for WHEELING. The circle is divided into four equal points: thence, *wheeling* to the right or left, is only a quarter of the circle; *wheeling* to the right or left about, is one half of the circle.

When you *wheel* to the right, you are to close to the right, so near as to touch your right hand man, but without pressing him; and to look to the left, in order to bring the rank about even.

W H E

When you *wheel* to the left, you are to close to the left, and look to the right, as above directed. This rule will serve for all *wheeling* by ranks; as when a battalion is marching by subdivisions with their rank open, then each rank *wheels* distinctly by itself, when it comes to the ground on which the ranks before it *wheel'd*, but not before.

In *wheeling*, the men are to take particular care neither to open nor close their ranks, and to carry their arms well.

In *wheeling*, the motion of each man is quicker or slower, according to the distance he is from the right or the left; thus, when you *wheel* to the right, each man moves quicker than his right-hand man; and, *wheeling* to the left, each man moves quicker than his left-hand man; the circle that every man *wheels* being larger, according to the distance he is from the hand he *wheels* to; as may be seen by describing several circles within one another, at two feet distance from each, which is nearly the space every man is supposed to take up.

WHEEL-carriages, in *artillery*, &c. The whole doctrine thereof, as it stands on a mathematical theory, may be reduced to the following particulars, viz.

1. **WHEEL-carriages** meet with less resistance than any other kind of carriage.

2. The larger the wheels, the easier is the draught of the carriage.

3. A carriage upon four wheels of equal size is drawn with less force than with two of those wheels, and two of a lesser size.

4. If the load be all on the axle of the larger wheels, it will be drawn with less force than if laid on the axis of the lesser wheels; contrary to the common notion of loading carriages before.

5. Carriages go with much less force on *friction-wheels*, than in the common way; all which we hope to explain by experiments.

The theory of wheel-carriages is as follows. Let *APGEM* (Plate XV. fig. 3) be a wheel, *ND* the horizontal plane on which it moves, *EF* the height of an obstacle over which it is to be drawn: the wheel arriving at the obstacle, and touching the top *E*, stands upon the point *G*, and presses it with its whole weight. Draw *OEK*, a tangent to the wheel in the point *E*, and meeting the vertical diameter *AG* produced, in *O*. Draw the radius *EC*, and *EH* perpendicular to *AG*; and *MC*, *mr*, perpendicular to *CE*, and consequently parallel to the tangent *OK*. Lastly, draw the radius *Cm*.

2. Since the wheel gravitates in the direction *GO*, let *CO* express its weight, pressing the point.

point G ; this may be resolved into two others, CE and OE ; of which CE presses the top of the obstacle, and is wholly sustained by it; the other weight OE draws the wheel down in a direction parallel to the tangent OK . Now let $W = CO$ weight of the wheel, $R =$ radius, $H = EF$, the height of the obstacle, and $x = OE$; then since $OE : CO :: HE : CE$, we

have $x : W :: HE : R$, whence $x = \frac{W \times HE}{R}$;

but, from the nature of the circle, $HE = \sqrt{AH \times HG} = \sqrt{AH \times EF} = \sqrt{2RH - H^2}$;

therefore $x = \frac{W \times \sqrt{2RH - H^2}}{R}$.

3. A force just equal to the weight x , and acting in opposition to it, that is, drawing the wheel upwards in the direction CM parallel to EK , will just be able to make the wheel rest on the top of the obstacle at E , without suffering any part of its weight to rest on the horizontal plane at G .

4. Now the force must be increased if it acts in any other direction but that of CM ; for let it draw the wheel in the direction Cm , between M and E , then the force may be resolved into two others, Cr , and rm , of which Cr draws the wheel directly against the top of the obstacle E , and so is destroyed by equal re-action of the point E ; what therefore remains to draw it upwards in a direction parallel to OK , is mr , which is less than CM or Cm ; and to be made equal thereto, (as it must be to support the wheel on the top of the obstacle E) it must be increased in the ratio of Cm to rm , which let be as R to S (for as radius to the sine of the angle which the direction of the force makes with CE). But it is plain, the force rm cannot be increased; but the whole force CM must be increased in the same proportion; that is,

when rm becomes $\frac{R}{S} \times rm$, CM will become

$$\frac{R}{S} \times CM = \frac{R}{S} \times \frac{W \times \sqrt{2RH - H^2}}{R} = \frac{W \times \sqrt{2RH - H^2}}{S}$$

5. In order that the wheels may be drawn over the obstacle FE , it is necessary the direction of the force should be between CE and CA ; for if it were in the direction CE , it could only draw the wheel upon or against, but not over the obstacle; and if it acted in the direction CA , it would not make it press against the obstacle, and consequently could not draw it over.

6. Let $F = \frac{W \times \sqrt{2RH - H^2}}{S}$ = the force suf-

ficient to sustain the wheel on the top E of the obstacle, it is evident if W , R , H , continue the

same, $F = \frac{1}{S}$; that is, the force will always be

less as the sine of the angle ECm is greater, 'till $rm = CM$, when the said force is least of all.

7. If W and H be given, or always the same,

then $F = \frac{\sqrt{2RH - H^2}}{R}$ (for here we suppose the force applied to draw in the most advantageous direction, viz. CM , where S become equal to R .) If therefore the radii of four wheels be

1, 2, 3, 4, then will $\frac{\sqrt{2RH - H^2}}{R}$ be 1, $\frac{\sqrt{3}}{2}$, $\frac{\sqrt{5}}{3}$, $\frac{\sqrt{7}}{4}$,

or as the numbers 1000, 866, 745, 661. From whence it is evident how much less force is necessary to draw a large wheel over any obstacle than a lesser one, when the weight of the wheels is the same.

8. If the height of the obstacle H be indefinitely small and given, in which case the tangent OK will coincide with the horizontal line ND , and the point E with the point G , very nearly; and the direction of the force be parallel to ND ; then because H^2 is inconsiderable we reject it, and the expression for the force

will be $F = \frac{W \times \sqrt{2R}}{R}$, (for H is given, and

therefore not expressed). And if W be also given,

the force will be $F = \frac{\sqrt{2R}}{R}$, or $F = \frac{\sqrt{R}}{R}$, be-

cause 2 is a given quantity; but $\frac{\sqrt{R}}{R} = \frac{1}{\sqrt{R}}$;

therefore $F = \frac{1}{\sqrt{R}}$; that is, in case of rough

uneven surfaces, the force to draw the wheel will be inversely as the square root of the radius or diameter of the wheel. Thus, if three wheels are in diameter as 1, 4, 9, the force to draw them will be as 3, 2, 1.

9. If $H = 0$, that is, if the horizontal plane on which the wheel moves be perfectly smooth

or plain, then the quantity $\frac{W}{S} \sqrt{2RH - H^2} = 0$; whence it appears that no force is required

quired to move a heavy body on an horizontal plane, which is perfectly even.

10. If the height H of the obstacle be proportional to the radius of the *wheel*; that is, if H be as R , and the force draw in a direction

parallel to OK ; then, because $\frac{\sqrt{2RH-H^2}}{R} = \frac{\sqrt{2RR-RR}}{R} = \frac{\sqrt{R}}{R} = 1$, therefore $F = W$,

or the force will be proportional to the weight of the *wheel*.

11. If the direction of the force be parallel to the horizontal plane; that is, if Cm be parallel ND ; then, because the angle mCE is (in that case) equal to the angle CEH , their sines will be equal, that is, $\sin m = CH = R - H$; therefore the expression of the force (art. 6.)

will become $F = \frac{W \times \sqrt{2HR-H^2}}{R-H}$; and if the

height be given, it will be $F = \frac{W \times \sqrt{2R-1}}{R-1}$.

12. From the expression $F = \frac{W \times \sqrt{2RH-H^2}}{S}$,

we have this equation $\frac{F}{W} = \frac{\sqrt{2HR-H^2}}{S}$, which

gives the following analogy $F:W::\sqrt{2HR-H^2}:S$; that is, the force is to the weight as the sine of the angle ECH (viz. EH) is to the sine of the angle mCE , which the line of direction makes with the line EC .

13. If the obstacle is capable of being depressed, or born down by the *wheel*, the larger the *wheel* the greater will be the force to do this; for since CE represents the whole force with which the *wheel* bears upon the obstacle, and this is resolvable into the two parts CH and HE , of which the former CH being parallel to EF , tends to press it down, it will be expressed by $R-H$; and since H is given, the depressing force will be as $R-1$, and therefore will increase with R , or the radius of the *wheel*.

14. If the obstacle be such, as that it can neither be surmounted nor depressed, but must be driven forward, the force to do that will be expressed by $HE = \sqrt{2RH-H^2}$, which, since H is given, will be as $\sqrt{R-1}$; but $\sqrt{R-1}$ will be greater in proportion to the R when R is small, than when it is greater. Thus, if $R = 2$, then $\sqrt{R-1} = 1 = \frac{1}{2}R$; but if $R = 5$, then $\sqrt{R-1} = 2$, which is less than $\frac{1}{2}R$;

and if $R = 10$, then $\sqrt{R-1} = 3$, which is less than $\frac{1}{2}R$; so that in this respect small *wheels* have the advantage of large ones: but this case seldom happens.

15. The principal advantage of small *wheels* is, that in them the line of traction is not parallel to the horizon as CK (fig. 4.) but inclined thereto in a certain angle as CM , making with the horizon the angle MCK ; now if CM be parallel to the tangent OK , the whole force will be employed to draw the *wheel* over the obstacle EF ; whereas, if the line of traction were parallel to the horizon, the line CK might express the force, which being resolved into the two forces CE and KE , shews that the part CE draws the *wheel* directly upon the obstacle, and is therefore lost by its reaction; and only the part KE remains to draw the *wheel* over the said obstacle; and consequently the horizontal direction is not the best, unless upon a smooth and even surface, where no obstacles and ascents are to be surmounted.

16. From what has been said, it is evident that a small *wheel*, whose radius is KE , and the line of traction parallel to OK , is equivalent to a large *wheel* whose radius is CK , and the line of traction parallel to the horizon ND ; but $EK:CK::HB:CB::CI:CE$; that is, the radius of the smaller *wheel* is to that of the larger, as the co-sine of the angle ECG to radius.

17. Though the force employed be never wholly spent in drawing, but when the direction is CN , (fig. 5.) parallel to the plane on which the *carriage* moves; yet if it be applied in that oblique direction CM , where the breast of the horse is higher than the axle of the *wheel* C , in which case only the part BM is employed in drawing, the other part CB is not however wholly lost, but is acting contrary to the gravity of the *carriage*, and by that means lessens somewhat of the weight of the load, by lifting it (as it were) along; for in this case the horse not only draws, but also carries along (in some measure) the load.

18. On the contrary, if the axle of the wheel be higher from the plane than the breast of the horse, that is, if the power be applied in the oblique direction CO , then the part DO draws the load along; but the part CD acting perpendicular on G , draws the load directly against the plane, and therefore increases the weight of the load, or the difficulty in drawing it; and is therefore the worst direction in which the force can be any how applied in drawing. Hence it follows, that (*ceteris paribus*) where the *wheels* of a carriage have their radius equal

to the height of the horse's breast, or traces, the draught will be easiest of all; and *wheels*, whose radii are less than that, are better than those *wheels* whose radii exceed it.

19. A small *wheel*, *BDC* (fig. 6.) will descend farther down between two obstacles *DF* and *CE*, than a larger *wheel* *ADC*, as is evident from the figure; and therefore the draught is more difficult, and subject to more shocks or jolts, with the small *wheel*, inasmuch as its axis, and consequently the weight of the load, must be raised to a greater height in order to get from between them.

20. Also in soft or yielding ground, a small *wheel* will sink deeper than a larger *wheel* charged with the same weight. Thus suppose *ABC* (fig. 7.) be the plane of the road, which is so soft as to permit the small *wheel* to sink down to *E*, then the weight must overcome the resistance of as much earth as the *wheel* in sinking has displaced; that is, as much as is equal to the segment *HED*: if now the larger *wheel* were to sink to the same depth, it must overcome the resistance of so much earth as is equal to the segment *AEC*, which is greater than *HED*; which is impossible, because the same weight can overcome but an equal resistance in either *wheel*; therefore the larger wheel will not sink so deep as the smaller, consequently will be drawn more easily.

21. Since the ends of the axles, and the holes in the naves of large and small *wheels* are equal, and since in passing along, the small *wheel* (to measure the length of the road) must turn round upon its axis oftener than a large one; it follows, that there will be a greater quantity of friction in the small *wheel* than in the larger, and that in the same proportion as it is less, or as its velocity is greater. Hence on account of this, and several other like causes, small *wheels* are much more subject to be out of repair, to be at fault, and to be worn quite out, than larger ones.

22. Next to the convenience mentioned, *art.* 14, that of turning the carriage in a smaller compass, with small *wheels*, than can be done by large ones, has made them more necessary in waggons and coaches; for, because of their smallness, they can be brought near to, and partly under, the sides of the carriage, and so their axes lying more obliquely under the bed of the carriage, admit it to be turned about with greater ease; but this should have no effect on carriages used in the artillery.

WICKET, a small door in the gate of a fortified place, through which people go in and out, without opening the great gate.

WINDAGE of a gun, mortar, or howitzer; the difference between the diameter of the bore, and the diameter of the shot or shell. In England the diameter of the shot is supposed to be divided into 20 equal parts, and the diameter of the bore into 21 of those parts. The French divide the shot into 26, and the bore into 27. The Prussians divide the shot into 24, and the bore into 25. The Dutch nearly the same as the English. The general windage of shells in England is $\frac{1}{4}$ of an inch, let them be large or small, which is contrary to all reason. It is evident, that the less windage a shot or shell has, the farther and truer it will go; and having less room to bounce from side to side, the gun will not be spoiled so soon.

It is true that some artillery officers say, that the windage of a gun should be equal to the thickness of the ladle; because, when it has been loaded for a while, the shot will not come out, without being loosened thereby, in order to unload it; and when this cannot be done, it must be fired away, and so lost: but in my humble opinion the most advantageous windage should be in dividing the shot into 24 equal parts, and the bore into 25, on account of the convenient scale it affords, not only to construct guns thereby, but also their carriages. Hence, agreeable to this plan, the windage of a 9-pounder will be .166 of an inch, consequently a sufficient thickness for a ladle; and those of a higher calibre become still thicker in proportion: but suppose this thickness is not enough, the loss of a shot is a mere trifle, in respect to the advantage got thereby.

WIND-gun. See AIR-GUN.

WINDLACE, is a roller of wood, square at each end, through which are either cross holes for hand-spikes, or staves across to turn it round: by this means it draws a cord, one end of which is fastened to some weight which it raises up. They are used in guns, and about Dutch mortars, to help to elevate them.

WINGS of an army, when drawn up in battle, are the right and left hand files; when a battalion is drawn up, the divisions on the right and left are called the wings. The word *wing* is sometimes used to denote the large sides of horn-works, crown-works, tenailles, and the like outworks, &c.

W I N

WINTER-quarters. See **QUARTERS.**

WOLF-holes, in the defence of places, are round holes, generally about 2 or 3 feet in diameter at the top, 1 at bottom, and 2½ deep, dug in the front of any work. Sometimes a sharp-pointed stake or two are fixed at the bottom, and covered with very thin planks,

W O R

and green sods; consequently the enemy, on advancing, fall in, and are put into confusion.

WORD, or *Watch-word.* See **PAROLE.**

WORDS of command, are the terms used by officers in exercising battalions or squadrons, or when they are in action.

WORDS of command used at the manual exercise, as ordered by His MAJESTY, viz.

Z	Words of command	Motions	EXPLANATIONS.	Z	Words of command	Motions	EXPLANATIONS.
1	<i>Poise your firelock!</i>	2	1st. Seize the firelock with your right hand, and turn the lock outwards, keeping the firelock perpendicular.				cock with the fore-finger and thumb of the right hand, the back of the hand turned up.
			2d. Bring up the firelock with a quick motion from the shoulder, and seize it with the left hand, just above the lock, so that the fingers may lie upon the stock, with the elbows down, and the thumb to lie upon the stock: the firelock must not be held too far from the body, and the left hand must be of an equal height with the eyes.	5	<i>Half-cock your firelock!</i>	1	I half-bend the cock briskly, with a draw-back of the right elbow, bringing it close to the butt of the firelock.
				6	<i>Handle your cartridge!</i>	1	Bring your right hand with a short round to your pouch, snapping it hard; seize the cartridge, and bring it with a quick motion to your mouth; bite the top well off, and bring the hand as low as the chin, with the elbow down.
2	<i>Cock your firelock!</i>	2	1st. Turn the barrel opposite to your face, and place your thumb upon the cock, raising your elbow square at this motion.	7	<i>Prime!</i>	1	Shake the powder into the pan, placing the three last fingers behind the hammer, with the elbow up.
			2d. Cock your firelock, by drawing your elbow down, placing your right thumb upon the breech-pin and the fingers under the guard.	8	<i>Shut your pans!</i>	2	1st. Shut your pans briskly, drawing your right arm at this motion towards your body, holding the cartridge fast in your hand, as in the former position.
3	<i>Present!</i>	1	Step back about 6 inches to the rear with the right foot, bringing the left toe to the front; at the same time the butt-end of the firelock must be brought to an equal height with the shoulder, placing the left hand on the swell, and the fore-fingers of the right-hand before the trigger, sinking the muzzle a little.				2d. Turn the piece nimbly round to the loading position, with the lock to the front, and the muzzle the height of the chin, bringing the right hand behind the muzzle; both feet kept fast in this motion.
				9	<i>Charge with cartridge!</i>	2	1st. Turn up your hand, and put the cartridge into the muzzle, shaking the powder into the barrel.
4	<i>Fire!</i>	1	Pull the trigger briskly, and immediately after bringing up the right foot to the inside of the left, come to the priming position, with the lock opposite to the right breast, the muzzle the height of the hat, keeping it firm and steady, and at the same time seize the				2d. Place your hand, closed, with a quick and strong motion upon the rammer.
				10	<i>Draw your rammer!</i>	2	1st. Draw the rammer with a quick motion half out, seizing it at the muzzle back-handed.
							2d. Draw it quite out, turn it, and enter it into the muzzle.

Ram

W O R

N ^o .	Words of command	Motions	EXPLANATIONS.
11	<i>Ram down your charge!</i>	1	Ram the cartridge well down the barrel, instantly recovering and seizing the rammer back-handed at the centre, turning it, and entering it as far as the lower pipe, placing at the same the edge of the hand on the butt-end of the rammer, with fingers extended.
12	<i>Return your rammer!</i>	1	Return the rammer, bringing up the piece with the left hand to the shoulder, seizing it with the right hand under the cock, keeping the left hand fast at the swell, turning the body square to the front.
13	<i>Shoulder your firelock!</i>	2	1st. Quit the left hand, and place it strong upon the butt. 2d. Quit the right hand, and throw it down the right side.
14	<i>Rest your firelock!</i>	3	1st. Seize the firelock with the right hand, turning the lock outwards. 2d. Raise the firelock from the shoulder, and place your left hand with a quick motion above the lock, holding the piece right up and down in both hands before you, and your left hand even with your eyes. 3d. Step briskly back with your right foot, placing it a hand's breadth distance from your left heel, and the same time bring down your firelock as quick as possible to the rest, sinking it as far down before your left hand as your right hand will permit without constraint; your left hand at the feather-spring, and your right, with fingers extended, held under the guard, taking care to draw in the muzzle well towards your body, and to dress in a line with the butt end.
15	<i>Order your firelock!</i>	3	1st. Place your firelock nimbly, with your left hand, against your right shoulder. 2d. Quit the firelock with the right hand, sinking it at the same time with your left; seize it at the muzzle, which must be of an equal

W O R

N ^o .	Words of command	Motions	EXPLANATIONS.
			height with your chin, and hold it close against your right side. 3d. Lift up your right foot, and place it by your left; at the same time throw back your left hand by your left side, and with your right bring down the butt end strong upon the ground, placing it even with the toe of your right foot; the thumb of your right hand lying along the barrel, and the muzzle kept at a little distance from your body.
6	<i>Ground your firelock!</i>	4	1st. Half face to the right upon your heels, and at the same time turn the firelock, so that the lock may point to the rear, and the flat of the butt-end lie against the inside of your foot; at the same time slipping the right foot behind the butt of the firelock, the right toe pointing to the right, and the left to the front. 2d. Step directly forward with your left foot, about as far as the swell of the firelock, and lay it upon the ground, your left hand hanging down by your left leg, and your right kept fast, with the butt-end against it. 3d. Raise yourself up again nimbly, bringing back your left foot to its former position, keeping your body faced to the right. 4th. Face again to the left upon your heels, and come to your proper front, letting your hands hang down without motion.
17	<i>Take up your firelock!</i>	4	1st. Face to the right upon both heels. 2d. Sink your body down, and come up to the position described in the second motion of grounding. 3d. Raise yourself and firelock, bringing it close to your right side. 4th. Come to your proper front, seizing your firelock at the muzzle, as in <i>Explanation 15</i> .
18	<i>Rest your firelock!</i>	3	1st. Bring your right hand as far as the swell. 2d. Raise

No.	Words of command	Motions	EXPLANATIONS.
			2d. Raise the firelock high up in a perpendicular line from the ground with your right hand, and seize it with your left above the spring; the cock the height of the waist-belt.
			3d. Step back with your right foot, placing it behind your left heel, and come to the rest.
19	Shoulder your firelock!	2	1st. Lift up your right foot, and place it by your left; bring the firelock at the same time to your left shoulder, and seize the butt end with the left hand, keeping it in the same position as above described.
			2d. Throw your right hand briskly back.
20	Secure your firelock!	3	1st. Bring the right hand briskly up, and place it under the cock, keeping the firelock steady in the same position.
			2d. Quit the butt with the left hand, and seize the firelock with it at the swell, bringing the elbow close down upon the lock; the right hand kept fast in this motion, and the piece still upright.
			3d. Quit the right hand, and bring it down your right side, bringing the firelock nimbly down to the <i>secure</i> ; the left hand in a line with the waist-belt.
21	Shoulder your firelock!	3	1st. Bring the firelock up to a perpendicular line, seizing it with the righthand under the cock.
			2d. Quit the left hand, and place it strong upon the butt.
			3d. Quit the right hand, and bring it smartly down the right side.
22	Fix your bayonet!	3	1st and 2d motions, as in the two first of the <i>secure</i> .
			3d. Quit the right hand, and bring the firelock smartly down to the left side with the left hand, as far as it will admit without constraint, seizing the bayonet at the same time with the right hand, and fixing it, placing that hand just below the brass, with the piece kept close to the hollow of the shoulder.

No.	Words of command	Motions	EXPLANATIONS.
23	Shoulder your firelock!	3	1st. Quit the right hand, and bring up the firelock with the left; seize it again under the cock with your right, as in the 2d motion of the <i>secure</i> .
			2. Quit the left hand, and place it strong upon the butt.
			3d. Quit the right hand, and bring it down the right side.
24	Present your arms!	3	As explained in the 3 motions of the 14th word of command.
25	To the right face!	3	1st. Bring up the firelock with a quick motion high before you, till your left hand comes even with your eyes, with the fingers of that hand extended along the stock, just above the feather-spring; the right foot to be brought close up to the left heel in this motion.
			2d. Face to the right, taking care in facing to hold the firelock right up and down, and steady in your hands.
			3d. Step back with your right foot, and come down to your <i>present</i> , as in the foregoing explanation.
26	To the right face!	3	As in the foregoing explanation, facing to the right.
27	To the right-about face!	3	As in the 25th explanation, only coming to the right-about, instead of to the right.
28	To the left face!	3	1st. Bring the right foot briskly to the hollow of your left with the firelock, in the same position as in the first motion of <i>facing to the right</i> .
			2. Face to the left.
			3. Come down to the <i>present</i> , as before.
29	To the left face!	3	As in the foregoing explanation.
30	To the left about face!	3	As before, coming to the left-about, instead of to the left.
31	Shoulder your firelock!	2	As in the two motions of the 19th explanation.
32	Charge your bayonet!	2	1st. As in explanation 1.
			2d. Bring the swell of the firelock down strong upon the palm of the hand, grasping the piece at the small, behind the lock, and as high as the waist-belt; the firelock

No.	Words of command	Motions	EXPLANATIONS.
			lock upon a level with the barrel upwards.
33	Shoulder your firelock!	2	1st. Bring up the firelock to the shoulder, place the left hand upon the butt, bringing the feet square to the front. 2d. Quit the right hand, and throw it down the right side.
34	Advance your arms!	4	1st and 2d, as in the 1st explanation. 3d. Bring the firelock down the right side, with the right hand, as low as it will admit without constraint, slipping up the left hand at the same time to the swell, the guard between the thumb and fore-finger of the right hand, the three last fingers under the cock, with the barrel to the rear. 4th. Quit the left hand.
35	Shoulder your firelock!	4	1st. Bring up the left hand, and seize it at the swell. 2d. Come smartly up to the poise. 3d and 4th. Shoulder.
36	Prime and load!	15	1st. Come smartly to the <i>recover</i> , by springing the firelock straight up with the left hand, turning the barrel inwards to the proper height of the <i>recover</i> : at the same time that the left hand springs the firelock, the right hand is raised briskly from the right side, and seizes the firelock across the breast; as it rises below the cock, the left hand comes with a quick motion from the butt, and seizes the firelock strong above the lock, the little finger of the left hand at the spring of the lock, the left hand at an equal height with the face, the butt close to the body, but not pressed, the firelock perpendicular, opposite the left side of the face. 2d. Bring the firelock down with a brisk motion to the priming position, the left hand holding the firelock, as in priming; the thumb of the right hand placed against the face of the steel, the fingers clinched, and the elbow a

No.	Words of command	Motions	EXPLANATIONS.
			little turned out, that the wrist may be clear of the cock. 3d. Open the pan by throwing up the steel with a strong motion of the right arm, turning the elbow in, and keeping the firelock steady in the left hand. 4th. Handle your cartridge. 5th. Priming. 6th. Shut your pans. 7th. Cast about. 8th and 9th. Load. 10th and 11th. Draw rammers. 12th. Ram down the cartridge. 13th. Return the rammers. 14th and 15th. Shoulder. N. B. The motion of <i>recover</i> , and coming down to the priming position, and opening pans, to be done in the usual time. The motions of handling cartridge to shutting the pans, to be done as quick as possible: when the pans are shut, a small pause is to be made, and then cast about together; then the loading motions are to be done as quick as possible; but before the rammer is returned, another small pause is to be made, counting 1, 2, between each motion, till the firelock is shouldered. Spring the firelock briskly to the <i>recover</i> , keeping the left-foot fast in this motion: as soon as the firelock is at the <i>recover</i> , without any stop, sink the body briskly without stooping forward, with a quick motion down upon the right knee: the butt end of the firelock at the same time falls upon the ground; the front part of the butt to be in a line with the heel of the left foot. So soon as the butt comes to the ground, the firelock is to be cocked, immediately seizing the cock and steel in the right hand; the firelock to be held firm in the left hand, about the middle of that part of the firelock between the lock and the swell of the stock; the point of the left thumb to be close to the swell, pointing upwards.
	Front rank, make ready!		

No.	Words of command	Motions	EXPLANATIONS.
			As the body is sinking, the right knee is to be thrown as far back as the left leg may be right up and down; the right foot to be thrown a little to the right; the body to be kept straight; the head up, looking to the right along the rank, the same as if shouldered; the firelock to be upright, and the butt about 4 inches to the right of the inside of the left foot.
	<i>Present!</i>	1	Bring the firelock briskly down to the <i>present</i> , by extending the left arm to the full length with a strong motion; at the same time spring up the butt by the cock with the right hand, and raise up the butt so high upon the right shoulder, that you may not be obliged to stoop too much with the head; the right cheek to be close to the butt, and the left eye shut, and look along the barrel with the right eye from the breech-pin to the muzzle; keep the left elbow down in an easy position, and stand as steady as possible; the thumb of the right hand to remain in the position, as described in the 3d Explanation of the Manual.
	<i>Fire!</i>	1	Pull the trigger, as directed in the Manual, and as soon as the piece is fired, give yourself a strong spring upon your left leg, raising your body briskly, and straight up, keeping your left foot fast, and bringing the right heel to the inside of the left; at the same time the firelock is to be brought up to the priming position, and half-cocked immediately; a short pause is to be made, then handle cartridge, and go on with the loading motions described in the Explanation of <i>prime and load</i> .
	<i>Centre rank, make ready!</i>		Spring the firelock briskly to the <i>recover</i> ; so soon as the left hand seizes the firelock above the lock, the right elbow is to be nimbly raised a little, placing the

No.	Words of command	Motions	EXPLANATIONS.
			thumb of that hand upon the cock; the fingers open by the plate of the lock, and as quick as possible force the piece to the cock, by dropping the elbow, and forcing down the cock with the thumb, stepping at the same time a moderate pace to the right, keeping the left foot fast: as the firelock is cocked, the thumb is to fall below the cock, the right hand seizing the firelock close under the cock, firmly; the forefinger not to be before the trigger; the piece to be held in this position perpendicular, opposite the left side of the face, the butt close to the left breast, but not pressed; the body to be straight, and as full to the front as possible; the head kept up, looking to the right of the rank, that the body and the firelock may not stoop forward, nor lean much out of the rank.
	<i>Present!</i>	1	Spring the firelock from the body to the arm's length with a quick motion, pressing down the muzzle with the left hand, and spring up the butt with the right hand, as in the foregoing Explanation of the <i>front rank</i> .
	<i>Fire!</i>	1	As in Explanation 4, in the Manual, with this difference, that the left foot is to be brought up to the right, at the same time that the firelock is brought down to the priming position.
			The loading motions as in the explanations of priming and loading, and at the last motion of shouldering, to spring to the left again, and cover the file-leaders.
	<i>Rear rank, make ready!</i>	1	Recover the firelock, and cock as before directed for the centre rank: as the firelock is recovered and cocked, step briskly straight to the right, with the right foot a full pace; bring the left heel about 6 inches before the right foot; the body straight, and as square to the front as possible, as in Explanation of the <i>centre rank</i> .

No.	Words of command	Motions	EXPLANATIONS.
1	<i>Present!</i>	1	As in Explanation <i>present</i> , before.
1	<i>Fire!</i>	1	As in Explanation of the <i>centre rank</i> , and as the firelock is coming down to the priming position,

No.	Words of command	Motions	EXPLANATIONS.
			the left is to be brought back to the right; and at the last motion of shouldering, to spring to the left again, and cover the file-leader.

The WORD, } is a peculiar word that serves
Watch-WORD, } for a token and mark of distinction, given out in the orders of the day in time of peace, but in war time every evening in the field by the general who commands, and in garrison by the governor, or other officer commanding in chief, to prevent surprise, and hinder an enemy, or any treacherous person to pass backwards and forwards. This *watch-word*

is generally called the *parole*, and to which is added the *counter-sign*. The first is known to all officers and non-commissioned officers, the latter only to the sentinels. The parole is this day, at Coxheath camp, *England*, and the counter-sign, *Amberst*. The officers that go the rounds, or patrols, exchange the word with the officers on duty; nor will the sentinels let any one pass that has not got the counter-sign.

WORDS of command used at the manual exercise of the grenadiers, when apart from the battalion.

No.	Words of command	Motions	EXPLANATIONS.
1	<i>Grenadiers, take care!</i>	1	The grenadiers bring the right hand briskly to the front of their caps; pause a little, and bring them down with a flap on their pouches, with life; in which motions, neither your heads, bodies, nor firelocks, are to move. N. B. <i>Poste your firelock! Cock your firelock! Present! Fire!</i> as in N ^o . 1, 2, 3, and 4, of the Manual Exercise.
2	<i>Sling your firelocks!</i>	3	1st. Bring the sling with the left hand opposite to the right shoulder, and the firelock with the right hand opposite the left shoulder, by crossing of both hands at the same time, bringing the left hand within the right, keeping the muzzle upright, the barrel to the left, and the right hand just under the left elbow. 2d. Bend the firelock back, and bring the sling over your head, placing it just above your right shoulder. 3d. Draw the sling with your left hand, and let go the firelock with the right at the same time, that it may hang by the sling on the right shoulder, the muzzle

No.	Words of command	Motions	EXPLANATIONS.
3	<i>Handle your matches!</i>	3	upwards, dropping both hands down by your sides at the same time. 1st. Bring both hands directly before you with half-stretched-out arms, about the height of your shoulders, taking hold of the lower end of the match with the right hand, placing the thumb under, and the two fore-fingers above. 2d. Bring the match with the right hand over the back of the left, placing it between the thumb and 2 fore-fingers of the said hand. 3d. Push out your left hand with the match straight forward, by extending the arm at full length, and at the same time bring your right hand down to your right side. 1st. Keep your left hand extended to the front, as before, and face nimbly to the right, stretching out your right arm at the same time the height of your shoulder, pointing directly to the rear. 2d. Clap your right hand briskly on
4	<i>Handle your grenades!</i>	3	

2	Words of command	Motions	EXPLANATIONS.	2	Words of command	Motions	EXPLANATIONS.
			on your pouch, seizing your grenade.				3d. Bring your right hand down to your side, keeping your left in its former position.
			3d. Bring your right hand to its former position, placing the thumb against the fuze.	9	Return your matches!	3	1st. Bring both hands before you, as directed by the first motion of Explanation 3.
5	Open your fuze!	3	1st. Keep your left hand extended to the front, and bring the grenade with your right hand to your mouth.				2d. Bring the match back to its former place, between the 2 last fingers of the left hand.
			2d. Open the fuze with your teeth.				3d. Let both hands fall down by your sides.
			3d. Push your arm briskly from you, to its former place.	10	Handle your slings!	3	1st. Seize the sling with both hands at the same time, taking hold of it with the right hand about the middle, and as low as you can reach, without bending your body.
6	Guard your fuze!	1	Cover your fuze with your thumb, without making any other motion.				2d. With the left hand bring the butt forwards, slipping your left elbow under the firelock, by bringing it between the firelock and the sling; taking hold of the firelock at the same time with the left hand, letting the stock lie between the thumb and fore finger, the butt end pointing a little to the left with the barrel upwards.
7	Blow your matches!	2	1st. Bring the match with your left hand before your mouth.				3d. Bring the firelock to lie on the left shoulder, and the sling on the right, the barrel upwards, and the butt end pointing directly to the front, keeping the firelock to a true level.
			2d. Blow it off with a strong blast, pushing back your hand at the same time to its former position.				N. B. The rest of the exercise is the same as the regiment.
8	Fire and throw your grenades!	3	1st. Meet the grenade with your left hand opposite to your right thigh, inclining your body to the right side, bending the right knee, and keeping the left stiff, firing the fuze at the same time.				
			2d. Let the fuze be well lighted; then throw the grenade with a stiff arm, stepping forward at the same time with the right foot, placing it in a line with the left, extending both arms in a direct line to the front, keeping the left uppermost, and the body upright.				

WORDS of command used by the cavalry on horseback.

It is presumed that the men are taught to ride, and the horses dress, in order to perform the following exercise.

1	Centre & rear rank move forward to close order. March!	[N. B. That no movement be made until the word <i>march</i> is given.] The two rear ranks of each squadron march forward and close so near, that only 4 men may just wheel round between each rank. The quarter-masters to be on the right of their respective squadrons, to give the ranks their proper distance, and to dress them, and	2	Officers rein back into the front rank!	then repair to their posts in the rear. This movement is to be done at a walk, and the men are to observe their right and left-hand men, that the ranks may be even in marching. At this word of command, the front rank of each squadron is to open a little to the right and left, to make proper intervals for the officers to fall into, who are to
					R k wait

N ^o .	Words of command	Motions	EXPLANATIONS.
3	<i>March</i>		wait for the following word of command. The officers rein back in a direct line into the front rank of the men, and dress with them: the cornets are to take the standards from the men.
4	<i>Shorten your bridles</i>	5	1st. Seize the upper end of the reins of the bridle, which is to lie on the right side of the horse, with the right hand. 2d. Bring it up as high as your chin, keeping your right elbow on a level with the shoulder. 3d. Slip your left hand along the reins of the bridle, and take hold of the loop or button, which is near the upper end of the reins. 4th. Slip the loop down with the left hand as low as the pomel of the saddle. 5th. Bring the right hand down with life on the right holster-cap, quitting the reins of the bridle with both hands.
5	<i>Make ready your carbines</i>	1	Unfasten the strap that holds the carbine; then bring your arm under it, seizing it about the middle with the right hand, letting it lie between the fore finger and thumb, and raising it a little, that the muzzle may run up by the point of the right shoulder.
6	<i>Advance your carbines</i>	3	1st. Raise your carbine upright in the bucket, slipping your hand at the same time up the barrel as high as the shoulder, with the elbow square. 2d. Slip the right hand down the barrel as low as you can without inclining the body, and grasp it with a full hand. 3d. Bring up the carbine with the right hand, and place the butt end on the upper part of the right thigh, near the body, turning the barrel towards you at the same time, the muzzle sloping to the front.
7	<i>Handle your swivels</i>	2	1st. Seize the swivel with your left hand, placing the thumb on the spring. 2d. Bring the swivel to the left

N ^o .	Words of command	Motions	EXPLANATIONS.
8	<i>Spring your carbines</i>	3	side of the carbine, opposite to the ring which you are to spring it to, raising your elbow as high as your hand. 1st. Open the swivel, by pressing your left thumb, and put it into the ring of the carbine, and then ease your thumb that the spring may close. 2d. Quit the carbine with the right hand, and take hold of the small part of the butt a little below the lock with a full hand. 3d. Quit the swivel with the left hand, and bring it to its proper place.
9	<i>Drop your carbines</i>	1	Drop the carbine on the right side, hanging by the swivel, and the muzzle lying cross the middle of the right toe; at the same time taking hold of the bridle with the left hand, and quitting the carbine with the right.
10	<i>Join your right hands to your swords</i>	1	Bring your right hand over your left arm, which arm you are to press close to your left side, and seize the handle of the sword with a full hand.
11	<i>Draw your swords</i>	2	1st. Draw your sword quite out of the scabbard, by raising up the right hand as high as your arm will permit, and keep the point of the sword a little higher than the hilt. 2d. Bring your right hand to your right side, placing the inside of the hilt on the outside of your right thigh, the wrist bending a little out, raising the point very high, in a right line with the right ear of the horse, with the edge from you.
12	<i>Place your swords in the bridle hands</i>	2	1st. Bring up the sword opposite to the centre of the body, resting the pomel on the fore part of the saddle, the broad part of the blade towards you, and the point upright; at the same time you are to slip up your left hand along the reins of the bridle as high as your shoulder, and seize the blade with your left hand, keeping the reins between the palm

W O R

W O R

No.	Words of command	Motions	EXPLANATIONS.
			palm and it, and squaring the left elbow.
			2d. Quit the sword with the right hand, and bring it to its proper place.
13	Handle your carbines!	1	Seize the round or small part of the butt with your right hand as high as your shoulder, and bring it immediately down to the aforementioned place.
14	Advance your carbines!	1	Bring your carbine with your right hand, placing it on your right thigh, as in Explanation 6.
15	Cock your carbines!	2	1st. Bring the right elbow forward, and place the right thumb on the cock. 2d. Bring down your right elbow to your side, cocking the carbine at the same time, and slipping the thumb off the cock.
16	Present!	1	Bring up the carbine, and place the butt end firm to the hollow of the right shoulder, dropping the muzzle to a level on the right side of the sword, and support it with the fingers of the left hand, which you are to extend for that purpose, and place the fore finger of the right hand before the trigger, and the other three on the guard, the thumb in the hollow of the butt, your body inclining a little forward only to press against the carbine, keeping your head up, and looking straight forward.
17	Fire!	1	Draw the trigger briskly with that finger that was placed before it; but should it not go off with the first drawing, you are not to draw it a second time.
18	Drop your carbines!	1	Drop your carbines on the right side, as in Explanation 9.
19	Handle your right pistols!	1	Bring your right hand round, turning the back towards you, and seize the butt of the right pistol with a full hand.
20	Draw your right pistols!	1	Draw your right pistol out of the holster, and bring it to the right side of the sword, extending your arm directly before you, with the muzzle upright.
21	Cock your pistols!	2	1st. Bring the pistol close to your breast, keeping the muzzle

No.	Words of command	Motions	EXPLANATIONS.
			up, and place your thumb on the cock.
			2d. Throw off the pistol to its former place, cocking at the same time, and slip your thumb off the cock.
22	Present!	1	Drop the muzzle to a level, the barrel upward, and place the fore finger on the trigger, as in Explanation 16.
23	Fire!	1	Draw the trigger, as in Explanation 17.
24	Return your pistols!	3	1st. Place the muzzle of your pistol in the holster, the back of your hand turned towards you. 2. Thrust it quite down. 3. Quit the pistol, and bring your right hand to its proper place.
25	Handle your left pistols!	1	Do this as in Explanation 19, only the back of your hand from you.
26	Draw your pistols!	1	As in Explanation 20.
27	Cock your pistols!	2	As in Explanation 21.
28	Present!	1	As in Explanation 22.
29	Fire!	1	As in Explanation 17.
30	Return your pistols!	3	As in Explanation 24.
31	Recover your swords!	2	1st. Seize the handle of the sword with the right hand, grasping it with the thumb upwards. 2d. Bring the sword to the right thigh, as in Explanation 11; at the same time slip down your left hand, and take hold of the bridle at the proper place.
32	Point your swords!	1	Bring your sword over the left arm, and enter the point in the scabbard, and thrust it so far, that you may look over the right arm.
33	Return your swords!	2	1st. Thrust your sword up to the hilt. 2d. Bring your hand back to its proper place.
34	Officers move into the front. March!		The commissioned officers are to march out of the ranks, the cornets bringing the standards with them, and place themselves at the head of the squadrons. As soon

No.	Words of command	Motions	EXPLANATIONS.	No.	Words of command	Motions	EXPLANATIONS.
			soon as the officers are clear of the men, the front ranks are to close the intervals, made by the officers, to the centre.				
35	<i>Centre and rear ranks rein back to open order. March!</i>	1	The centre and rear ranks of each Squadron are to rein back very slow, in a direct line to their former ground, keeping their ranks and files even; of which the quarter-masters are to take particular care, as also that there be a due distance between the ranks, according to the direction in Article 8.	39	<i>Return your swivels!</i>	2	1st. Place the swivel on your right side, by thrusting your left hand under your right arm.
			This is to be done as in Explanation 13.				2d. Bring your left hand back to its proper place.
36	<i>Handle your carbine.</i>	1	As in Explanation 14.	40	<i>Return your carbines!</i>	4	1st. Throw the carbine to the right with the right hand, turning the barrel to the front, sinking it as low as you can without inclining your body, seizing the barrel at the same time with your left hand, and keeping the muzzle upright.
37	<i>Advance your carbines!</i>	1	Quit the reins of your bridle, and take hold of the swivel with the left hand, placing the thumb on the spring, and opening it; at the same time take it out of the ring.				2d. Quit the right hand, and bring the carbine with the left hand under the right arm, sinking it near the bucket, and at the same time seize the barrel with the right hand a little above the left.
38	<i>Unspring your carbines!</i>	1					3d. Place the butt end of the carbine in the bucket, and quit it with the left hand.
							4th. Fasten the carbine with the strap, and place your bridle in your left hand.

WORDS of command for dismounting, linking the horses, &c.

1	<i>Dismount!</i>	6	1st. Take your right foot out of the stirrup, at the same time thrusting forward your bridle-hand, keeping the reins fast.				with the left, bringing it down to the ground, and place it even with the other.
			2d. Take a lock of the horse's mane with the right hand, and put it in the left, over the bridle, and grasp it fast with the left hand.				6th. Quit the bridle and mane with the left hand, wheeling at the same time to the left-about on the right heel, and take hold of the left cheek of the bridle with the right hand.
			3d. Take hold with the right hand of the right bar of the saddle, placing your fingers on the inside, and your thumb on the outside.	2	<i>Make ready your links!</i>		As there are several sorts of links, there cannot be one method prescribed for the whole; but as most regiments link with collars, we will proceed in that way.
			4th. Raise yourselves with the right hand above the saddle, and bring the left leg over to the near or left side of the horse, with an upright body, looking full to the right.				The collar being fastened by a running knot to a ring on the saddle, a little above the right holster, the men are to undo the knot with the right hand, taking the rein of the collar out of the ring, and laying it cross the horse's neck.
			5th. Come briskly to the ground with the right foot, facing full to the rear, and then quit the stirrup				

WORDS of command used at the exercise of the artillery, together with the number of hands and implements for that purpose.

On batteries, there are eight men required in the management and exercise of a heavy piece of artillery, who are posted in the following manner.

1st. A non-commissioned officer to superintend the whole: his duty is, to point the gun at the object, and to observe the effects of each shot.

2d. A man to load, placed on the left of the gun. When the piece is to be loaded with a paper or parchment cartridge, he must be provided with a pen-knife or pair of pointed scissors, to cut an oblong hole in the upper part of the cartridge opposite the seam, beginning at the bottom, about 3 inches long, and 2 broad, and double the paper back upon the cartridge, which he then puts into the piece. This opening is to let the priming communicate with the charge.

3d. A man to load with the ladle, to sponge and ram home: his post is on the right of the gun. These two men are carefully to avoid exposing their bodies in the line of fire, while loading.

4th. A man to serve the vent: his post is on the right of the gun, near the breech, but clear of the carriage.

5th. A man to fire: his post is on the left of the gun, near the breech, but clear of the carriage.

6th and 7th. Two men to handle the hand-spikes: they are placed on each side of the carriage.

8th. A man to serve with ammunition from the magazine, waggon, or chest: he is to be provided with a leather pouch, and is to stand about 40 or 50 paces in the rear.

N. B. At exercise, the arms are either piled or placed against the parapet, and the implements ranged in the following manner, viz. a sponge and ladle upon the right; a sponge and wad-hook upon the left; the hand-spikes upon the right and left.

In the field there are 13 men and 1 non-commissioned officer, posted as follows, viz.

1st. A non-commissioned officer to superintend the whole: his chief care is to point the gun, and observe the effects of each shot.

2d. A non-commissioned officer, or an able gunner, to steer and direct the gun: his post is on the left.

3d. A man to fire: his post is on the left of the gun.

4th. A man to serve the vent: his post is on the right of the gun.

5th. A man to load: his post is on the left of the gun, between the muzzle and the wheel.

6th. A man to sponge and ram home: his post is on the right of the gun, between the muzzle and the wheel.

7th. A man to serve with ammunition: his post is on the left of the gun, without the wheel.

8th. A man to serve ammunition from the magazine, waggon, or chest: posted about 30 or 40 paces in the rear of the gun.

9th. Six men at the drag-ropes, which lay hold of the wooden pins; 3 men to each drag-rope.

N. B. The number of men for the drag-ropes must be in proportion to the nature of the guns.

At exercising the slow motions, a hand-spike is laid on the ground in the front of the wheels; the ladle with the mouth downwards on the right, the wad-hook on the left, and the sponge in the centre.

TABLE of the number of men requisite for working the under-mentioned guns and howitzers.

Species	Cannon					Howitzers		
Natures	24	12	9	6	3	8	5 $\frac{1}{2}$	4 $\frac{1}{2}$
To superintend, non-commissioned officers	1	1	1	1	1	1	1	1
To steer the guns	1	1	1	1	1	1	1	1
To prime and fire	2	2	2	2	2	2	2	2
To load and set home	2	2	2	2	2	2	2	2
To the drag-ropes	12	10	8	6	4	8	4	4
To unload the waggon	4	3	3	2	1	3	2	2
Total	22	19	17	14	11	17	12	12

N. B. The above guns are all of the light fort, except the 8-inch howitzer.

Instead.

W O R

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Instead of Words of Command at the exercise of artillery, the drum beats Signals, viz.

Signals by the drum.	EXPLANATIONS.	Signals by the drum.	EXPLANATIONS.
1 <i>Preparative.</i>	To fire two round's from the flanks to the centre, or more if the officer who commands chuses.	drag-ropes, retreating the pieces in battery, firing as they retreat.	
2 <i>First part of the general.</i>	To cease firing, as above directed.	8 <i>First part of the general.</i>	To halt and cease from firing; at which time the men at the drag-ropes draw up in a line, holding the drag-ropes in their hands, and the men at their proper stations.
3 <i>March.</i>	To advance; that is, the men at the drag-ropes advance the pieces in battery, in a direct line.	9 <i>Flam.</i>	To unhook the drag-ropes, and fix them to the draught-rings at the end of the axle-tree; to be in readiness for advancing.
4 <i>Preparative.</i>	The firing commences again, advancing.	10 <i>Long-roll.</i>	To change about; that is, no one should be kept to one particular post, but changed regularly; so that each man be equally acquainted with every part of his duty.
5 <i>First part of the general.</i>	To cease firing, advancing.		
6 <i>Flam.</i>	To unhook the drag-ropes, and fix them to the trail of the gun-carriage.		
7	To retreat; that is, the line begins to retreat, by the men at the		

N. B. The Mortar and Howitzer exercise is similar to this. The men are likewise taught to mount and dismount all kinds of artillery, &c. as also to rig and unrig a gin.

WORKMEN, are persons that attend the ammunition, boatmen, carpenters, smiths, millers, bakers, waggoners, miners, pioneers, &c.

WORKS, are generally understood of the fortifications about the body of a place; as by *out-works* are meant those without the first inclosure. The word is also used to signify the approaches of the besiegers, and the several lines, trenches, &c. made round a place, an army, or the like, for its security.

WOODEN bottoms, in *laboratory works*, are cylindrical pieces of wood, of different lengths and diameters, agreeable to the size of the gun: they are hollowed at one end to receive the shot, and the flannel cartridge is fastened to the other end; the whole forming one cartridge, which is put into the piece at one motion.

WOOL-packs, in the *art of war*, are frequently ranged in form of a breast-work, because they resist cannon-shot. See **SIEGE**.

Y

YEOMAN, in *military affairs*, was anciently a kind of ceremonious title given to the soldiers.

YEOMEN of the guards, were anciently 250 men of the best rank, under gentry, and of larger stature than ordinary, each being required to be 6 feet high. At present there are but 100 yeomen in duty, and 70 more not in duty; and as any of the hundred dies, his place is supplied out of the 70. This corps

was first instituted by Henry VII. anno 1486.

YOUNGER regiment, is that which was last raised. See **SENIORITY**.

YOUNGER officer, is he whose commission is of the latest date, though he be ever so old a man, or have served ever so long in other capacities; and according to these rules, regiments and officers are posted and commanded, See **SENIORITY**.

Z

ZIG-ZAG, in the *art of war*, is a linemaking several angles, in approaching or erecting a work in a siege, &c. to prevent the besiegers

from being fired on in a straight line, or enfiladed.

SUPPLEMENT.

S U P P L E M E N T.

*The Words marked * are Omissions; the others, not marked, are further Explanations of Words already mentioned in the Work.*

A

A B L

ABLECTI, in *military antiquity*, a choice or select part of the soldiery in the Roman armies, picked out of those called *extraordinarii*.

* ABOLLA, in *military antiquity*, a warm kind of garment, generally lined or doubled, used both by the Greeks and Romans, chiefly out of the city, in following the camp.

* ABSCISSA, in *military mathematics*, signifies any part of the diameter or axis of a curve, contained between its vertex or some other fixed point, and the intersection of the ordinate.

In the parabola, the *abscissa* is a third proportional to the parameter and the ordinate.

In the ellipsis, the square of the ordinate is equal to the rectangle under the parameter and *abscissa*, lessened by another rectangle under the said *abscissa*, and a fourth proportional to the axis, the parameter, and the *abscissa*.

In the hyperbola, the squares of the ordinates are as the rectangles of the *abscissa* by another line, compounded of the *abscissa* and the transverse axis.

But it must be remembered, that the two proportions relating to the ellipsis and hyperbola, the origin of the *abscissas*, or point from whence they began to be reckoned, is supposed to be the vertex of the curve, or, which amounts to the same thing, the point where the axis meets it; for if the origin of the *abscissas* be taken from the centre, as is often done, the above proportions will not be true.

ACADEMY, is more frequently used amongst the moderns for a regular society,

A C O

or company, of learned persons, instituted under the protection of a prince, for the cultivation and improvement of arts or sciences. Some authors confound *academy* with university; but, though much the same in Latin, they are very different things in English. An university is, properly, a body composed of graduates in the several faculties; of professors, who teach in the public schools; of regents or tutors, and students who learn under them, and aspire likewise to degrees: whereas an *academy* was originally not intended for teaching, or to profess any art, but to improve it; it was not for novices to be instructed in, but for those who were more knowing, for persons of distinguished abilities to confer in, and communicate their lights and discoveries to each other, for their mutual benefit and improvement. The first *academy* we read of, was established by Charlemagne, at the motion of Alcuin: it was composed of the chief wits of the court, the emperor himself being a member.

*ACANZI, in *military history*, the name of the Turkish light-horse that form the van-guard of the Grand Signior's army on a march.

*ACCENDONES, in *military antiquity*, a kind of gladiators, whose office was to excite and animate the combatants during the engagement.

ACCENSI, in *military antiquity*, was also an appellation given to a kind of adjutants, appointed by the tribune to assist each centurion and decurion.

*ACOLUTHI, in *military antiquity*, was a title in the Grecian empire, given to the captain

tain or commander of the *varangi*, or bodyguards, appointed for the security of the emperor's palace.

* **ACCONTIUM**, in *ancient military writers*, a kind of Grecian dart or javelin, somewhat resembling the Roman *pilum*.

ACCOUTREMENTS, should be made of stout, smooth buff, as well for the service to be expected from them, as for their superior look above the spongy kind, which is always stretching, and difficult to clean. The buff belts are about 2½ inches broad, with two buckles to fix them to the pouch. Pouches are made of the floutell blackened calf-skin, especially the outside flaps, which are of such a substance as to turn the severest rain. Cartridge-boxes are made as light as possible, with 36 holes in each, to hold so many cartridges. The bayonet-belt is also 2½ inches broad, and better worn over the shoulder than about the waist.

* **ÆNEATORES**, in *military antiquity*, the musicians in an army; including those who sounded the trumpets, horns, *litui*, *buccinæ*, &c.

* **AGE**, in a *military sense*, or that wherein the Romans were obliged to enter themselves in the army, was at 17 years; at 45 they might demand their discharge. Amongst the Lombards, the age of entry was between 18 and 19; among the Saxons, at 13.

* **AGEMA**, in the *ancient military art*, a kind of soldiery chiefly in the Macedonian armies. The word is Greek, and literally denotes vehemence; to express the strength and eagerness of this corps. Some authors will have *agema* to denote a certain number of picked men, answering to a legion among the Romans.

* **AGGER**, in *ancient military writers*, denotes the middle part of a military road, raised into a ridge, with a gentle slope on each side, to make a drain for the water, and keep the way dry.

AGGER, is also used for the whole road, or military way. Where highways were to be made in low grounds, as between two hills, the Romans used to raise them above the adjacent land, so as to make them of a level with the hills. These banks they called *aggeres*. Bergier mentions several in the *Gallia Belgica*, which were thus raised 10, 15, or 20 feet above ground, and 5 or 6 leagues long. They are sometimes also called *aggeres calceati*, or causeways, as with us.

AGGER, also, denotes a work of fortification, used both for the defence and the attack of towns, camps, &c. in which sense, *agger* is the same with what was otherwise called *vallum*, and

in latter times, *agestum*; and among the moderns, *lines*; sometimes, *cavaliers*, *terrasses*, &c.

The *agger* was usually a bank, or elevation of earth, or other matter, bound and supported with timber; having sometimes turrets on the top, wherein the workmen, engineers, and soldiery, were placed. It was also accompanied with a ditch, which served as its chief defence. The height of the *agger* was frequently equal to that of the wall of the place. Cæsar tells us of one he made, which was 30 feet high, and 330 feet broad. Besides the use of *aggers* before towns, they generally used to fortify their camps with the same; for want of which precaution, divers armies have been surprised and ruined.

There were vast *aggers* made in towns and places on the sea-side, fortified with towers, castles, &c. Those made by Cæsar and Pompey, at Brundisium, are famous. Sometimes *aggers* were even built across arms of the sea, lakes, and morasses; as was done by Alexander before Tyre, and by M. Antony and Cassius.

The wall of Severus, in the north of England, may be considered as a grand *agger*, to which belong several lesser ones. Besides the principal *agger* or *vallum*, on the brink of the ditch, Mr. Horsley describes another on the south side of the former, about 5 paces distant from it, which he calls the south *agger*; and another larger one, on the north side of the ditch, called the north *agger*. This latter he conjectures to have served as a military way; the former, probably, was made for the inner defence, in case the enemy should beat them from any part of the principal *vallum*, or to protect the soldiers against any sudden attack from the provincial Britons.

AGGER Tarquiniæ, was a famous fence built by Tarquinius Superbus, on the east side of Rome, to stop the incursions of the Latins, and other enemies, whereby the city might be invested.

AGGER, is also used for the earth dug out of a ditch or trench, and thrown upon the brink of it: in which sense, the Chevalier Follard thinks the word to be understood, when used in the plural number, since we can hardly suppose they would raise a number of cavaliers, or terrasses.

AGGER, is also used for a bank or wall, erected against the sea, or some great river, to confine or keep it within bounds; in which sense, *agger* amounts to the same with what the ancients called *tumulus* and *moles*; the Dutch, *dyke*; and we, *dam*, *sea-wall*, &c.

* **AGIADES**,

* **AGIADES**, in the *Turkish armies*, are a kind of pioneers, or rather field-engineers, employed in fortifying camps, &c.

* **ALLÆ**, in the *ancient military art*, the two wings or extremes of an army ranged in order of battle.

ALLIANCES, are variously distinguished, according to their object, the parties in them, &c. Hence we read of equal, unequal, triple, quadruple, grand, offensive, defensive *alliances*, &c. See **ALLIANCE**, in the first Alphabet.

ALTITUDE of a figure, is the distance of its vertex from its base, or the length of a perpendicular let fall from the vertex to the base.

ALTITUDE of a shot or shell, is the perpendicular height of the principal vertex above the horizon. See **GUNNERY** and **PROJECTILES**.

ALTITUDE, in *optics*, is usually considered as the angle subtended between a line drawn through the eye, parallel to the horizon, and a visual ray emitted from an object to the eye.

ALTITUDE, in *cosmography*, is the perpendicular height of an object, or its distance from the horizon upwards.

ALTITUDES are divided into *accessible* and *inaccessible*.

Accessible ALTITUDE of an object, is that whose base you can have access to, i. e. measure the nearest distance between your station and the foot of the object on the ground.

Inaccessible ALTITUDE of an object, is that when the foot or bottom of it cannot be approached, by reason of some impediment; such as water, or the like. The instruments chiefly used in measuring of *altitudes*, are the quadrant, theodolite, geometric quadrant, or line of shadows, &c.

ALTITUDE of the eye, in *perspective*, is a right line let fall from the eye, perpendicular to the geometrical plane.

AMMUNITION, or *gun-powder*, may be prohibited to be exported at the king's pleasure, by Car. II. cap. 4. § 13.

AMMUNITION. Arms, utensils of war, or gunpowder, imported without licence from his majesty, are to be forfeited with treble the value. Such licence obtained, except for the furnishing his majesty's public stores, is to be void, and the offender to incur a premunire, and be disabled to hold any office from the crown. See **AMMUNITION**, in the first Alphabet.

Proportion of AMMUNITION for the following troops for one year, commencing the 25th of March, 1760, agreeable to the king's warrant, in time of peace.

		Pow.	Ball			Flints		
		Barrels	Muf- quets	Car- bines	Pistols	Muf- quets	Car- bines	Pistols
			C.	C.	C.	N ^o .	N ^o .	N ^o .
A regiment of foot of 900 men	{ service	13½	35			2700		
	{ exercise	19	11			1800		
A reg. of dragoons of 360 men	{ service	5	9		2	1134		2263
	{ exercise	7	1			756		1512
A light troop of 121 men	{ service	2½		} 7 {			363	393
	{ exercise	11½					242	262

N. B. The proportion of *ammunition* for a regiment of foot is 64 rounds for each man for service, at 6 drams each cartridge; and 135 rounds for each man for exercise, at ¼ of an ounce.

Musquet-flints, 3 to each man for service, and 2 for exercise.

Musquet-balls, 20 to each man for exercise.

The proportion for a regiment of dragoons is, 1lb. of powder for service, and 2lb. for exercise, to each man; each cartridge to contain the same as those of the foot.

The proportion for the light-dragoons is 64 rounds for each man for service, at ½ an ounce

each cartridge, and 405 rounds each man, for exercise, at 3 drams each cartridge.

The royal regiment of artillery, as much as the commanding officer thinks proper.

The militia when embodied to have the same as a regiment of foot, according to their numbers.

* **ANACLETICUM**, in the *ancient art of war*, a particular blast of the trumpet, whereby the fearful and flying soldiers were rallied and recalled to the combat.

* **ANDABATÆ**, in *military antiquity*, a kind of gladiators, who fought hoodwinked; having a sort of helmet that covered the eyes and face.

They were called *andabate*, *quasi αναβατες*, *ascensores*, because they fought mounted on horseback, or out of chariots.

* **ANGARIA**, in *ancient military writers*, means a guard of soldiers posted in any place for the security of it.

ANGON, in *ancient military history*, a kind of javelin used by the French. The iron head of it resembles a fleur-de-lis; and it is the opinion of some writers, that the arms of France are not fleurs-de-lis, but the iron point of the *angon* or javelin of the ancient French. See **ANGON**, in the first Alphabet.

* **AQUEDUCTS**, in *military architecture*, are generally made to bring water from a spring or river to a fortress, &c. they are likewise used to carry canals over low ground, and over brooks or small rivers: they are built with arches like a bridge, only not so wide, and are covered above by an arch, to prevent dust or dirt from being thrown into the water. See Muller's *Practical Fortification*.

ARAIGNE. See **GALLERY** and **MINE**.

ARBALET, in the *ancient art of war*, a cross-bow, made of steel, set in a shaft of wood, with a string and trigger, bent with a piece of iron fitted for that purpose, and used to throw bullets, large arrows, darts, &c.

ARCHERS, in *military history*, a kind of militia or soldiery, armed with bows and arrows. They were much used in former times, but now laid aside, excepting in Turkey, and some of the eastern countries.

ARCHERY, the art of shooting with bow and arrow. It is forbid, by statute, to shoot at a standing mark, unless it be for a rove, where the *archer* is to change his mark at every shot. Any person above 24 years old is also forbid to shoot with any prick-shaft, or flight, at a mark of eleven score yards or under. 33 Hen. VIII. chap. 9. The former was a provision for making good marksmen at fight; the latter, for giving strength and sinews. See **ARCHERY**, in the first Alphabet.

ARMATURA, is also an appellation given to the soldiers who were light-armed. Aquinas seems, without reason, to restrain *armatura* to the *tyrcnes*, or young soldiers, in it. Under this word is understood, the throwing of the spear, javelin, shooting with bows and arrows, &c.

ARMATURA, is also a denomination given to the soldiers in the emperor's retinue. See **ARMATURA**, in the first Alphabet.

ARMS, in a *general sense*, includes all kinds of weapons, whether for defence or offence. It is supposed, that the first artificial arms were of

wood, and only employed against beasts; and that Belus, the son of Nimrod, was the first that waged war: whence, according to some, came the appellation *bellum*. Diodorus Siculus takes Belus to be the same with Mars, who first trained soldiers up to battle. *Arms* of stone, and even of brass, appear to have been used before they came to iron and steel. Josephus assures us, that the patriarch Joseph first taught the use of iron arms in Egypt, arming the troops of Pharaoh with a casque and buckler.

The principal *arms* of the ancient Britons were hatchets, scythes, lances, swords, and bucklers: the Saxons, &c. brought in the halberd, bow, arrows, arbalets, &c. By the ancient laws of England, every man was obliged to bear arms, except the judges and clergy. Under Henry VIII. it was expressly enjoined on all persons to be regularly instructed, even from their tender years, in the exercise of the *arms* then in use, viz. the long-bow and arrows; and to be provided with a certain number of them.

By the common law, it is an offence for persons to go or ride armed with dangerous weapons; but gentlemen, both in and out of the army, may wear common armour, according to their quality. The king may prohibit force of *arms*, and punish offenders according to law; and herein every subject is bound to be aiding. Stat. 7 Edw. I. None shall come with force and *arms* before the king's justices, nor ride armed in affray of the peace, on pain to forfeit their armour, and to suffer imprisonment, &c. 2 Edw. III. c. 3. The importation of *arms* and ammunition is prohibited by 1 Jac. II. c. 8, and by William and Mary, stat. 2. c. 2. So likewise *arms*, &c. shipped after prohibition, are forfeited, by 29 Geo. I. c. 16. sec. 2.

ARMS of parade, or *courtesy*, were those used in the ancient jousts and tournaments; which were commonly unshod lances, swords without edge or point, wooden swords, and even canes. See **ARMS**, in the first Alphabet.

ARMY. Our armies anciently were a sort of militia, composed chiefly of the vassals and tenants of the lords. When each company had served the number of days or months enjoined by their tenure, or the customs of the fees they held, they returned home.

ARMY of observation, is employed to watch and observe the motions of an enemy; and by besiegers, to prevent relief being brought into a place, or the siege being raised by the enemy. See **ARMY**, in the first Alphabet.

ARTIFICERS, in a *military sense*, are those who

who make all kinds of fire-works, and prepare all the different sorts of laboratory stores; as also, smiths, collar-makers, carpenters, wheelwrights, gun-smiths, lock-smiths, rope-makers, &c. Most of the foreign regiments of artillery have one company of *artificers*.

* **ARX**, in the *ancient military art*, implies a town, fort, castle, &c. for the defence of a

place. The *arx*, in ancient Rome, was a distinct edifice from the Capitol, though some have confounded the two. According to Ryckius, the *arx*, properly speaking, was a place on the highest part of the Capitoline mount, stronger and better fortified than the rest, with towers and pinnated walls, in which was also the temple of Jupiter Capitolinus.

B

* **BANDERET**, in *military history*, implies the commander in chief of the troops of the canton of Bern, in Switzerland.

* **BANNERS**, in the *horse equipage*, for the kettle-drums and trumpets, to be of the colour of the facing of the regiment. The badge of the regiment, or its rank, to be in the centre of the banner of the kettle-drums, as on the second standard. The king's cypher and crown to be on the banner of the trumpets, with the rank of the regiment in figures underneath. The depth of the kettle-drum banners to be 3 feet 6 inches; the length 4 feet 8 inches, excluding the fringe. Those of trumpets to be 12 inches in depth, and 18 inches in length.

* **BARBET battery**, in *gunnery*, is when the breast-work of a battery is only 3 feet high, that the guns may fire over it without being obliged to make embrasures: in such cases, it is said the guns fire *en barbet*. See **BATTERY**, in the first Alphabet.

* **BATTLEMENTS**, in *military affairs*, are the indentures in the top of old castles or fortified walls, or other buildings, in the form of embrasures, for the greater conveniency of firing or looking through.

BAT-men, } a kind of servants in the army,

BAW-men, } that take care of the baggage-horses.

* **BAT-horses**, } are baggage-horses belong-

* **BAW-horses**, } ing to the officers when on actual duty.

* **BEACON**, a signal for the better securing the kingdom from foreign invasions.

On certain eminent places of the country are placed long poles erect, whereon are fastened pitch-barrels to be fired by night, and smoke made by day, to give notice, in a few hours, to the whole kingdom, of an approaching invasion.

* **BEAR**, in *gunnery*. A piece of ordnance is said to *bear*, or come to *bear*, when pointed directly against the object; that is, pointed to hit the object.

BELTS, in the *army*, are of different sorts, and for various purposes, viz.

Shoulder-BELTS for the dragoon-guards, horse and dragoons, to be $4\frac{1}{2}$ inches broad; those of the light dragoons to be $2\frac{1}{2}$ inches broad. Regiments that have buff waistcoats, are to have buff-coloured accoutrements, and those which have white waistcoats, to have white.

Waist-BELTS, to be $2\frac{1}{2}$ inches broad, except those of the light dragoons, which are to be $1\frac{1}{2}$ inches only; to have yellow buckles or clasps: the horse to have *cross belts*; the dragoon-guards and dragoons to have only one *shoulder-belt*, except the 8th regiment, which is permitted to wear *cross-belts*.

BELTS are known among the ancient and middle-age writers by divers names, as *ζώνη*, *ζώνη*, *zona*, *cingulum*, *remniculum*, *ringa*, and *baldrellus*. The *belt* was an essential piece of the ancient armour, inasmuch that we sometimes find it used to denote the whole armour. In latter ages the *belt* was given to a person when he was raised to knighthood: whence it has also been used as a badge or mark of the knightly order.

BENDINGS, in *military and sea matters*, are ropes, wood, &c. bent for several purposes. M. Amontons gives several experiments concerning the *bending* of ropes. The friction of a rope *bent*, or wound round an immovable cylinder, is sufficient, with a very small power, to sustain very great weights. Divers methods have been contrived for *bending* timber, in order to supply crooked planks and pieces for building ships; such as by sand, boiling water, steam of boiling water, and by fire. See M. Du Hamel, in his book called *Du Transport, de la Conservation, & de la Force des Bois*. M. Delesne ingeniously enough proposed to have the young trees bent, while growing in the forest. The method of *bending* planks by sand-heat, now used in the king's yards, was invented by captain Cumberland.

A method has been lately invented and practised for *bending* pieces of timber, so as to make the wheels of carriages without joints. The *bending* of boards, and other pieces of timber for

for curved works in joinery, is effected by holding them to the fire, then giving them the figure required, and keeping them in this figure by tools for the purpose.

BENEFICIARI, in *ancient military history*, denotes soldiers who attend the chief officers of the army, being exempted from all other duty.

BEN FICIARI were also soldiers discharged from the military service or duty, and provided with *beneficia* to subsist on.

* **BLOCK battery**, in *gunnery*, a wooden battery for two or more small pieces, mounted on wheels, and moveable from place to place; very ready to fire *en barbet*, in the galleries and casemates, &c. where room is wanted.

* **Block-house**, in the *military art*, a kind of wooden fort or fortification, sometimes mounted on rollers, or on a flat-bottomed vessel, serving either on the lakes or rivers, or in counter-scarps and counter-approaches. This name is sometimes given to a brick or stone building on a bridge, or the brink of a river, serving not only for its defence, but for the command of the river, both above and below.

BORE. See **CANNON**, in the first Alphabet.

BRANCH of a mine. See **MINE**, in the first Alphabet.

BRIDGES. See **BRIDGE**, in the first Alphabet.

BRIDGES are generally placed in a direction perpendicular to the stream in a direct line, to give free passage to the water. They are made of carpentry or masonry. The number of arches of a *bridge* is generally made odd; either that the middle of the stream or chief current may flow freely without interruption of a pier; or that the two halves of the *bridge*, by gradually rising from the ends to the middle, may there meet in the highest and largest arch; or else, for the sake of grace, that by being open in the middle, the eye in viewing it may look directly through there, as we always expect to do in looking at it, and without which opening we generally feel a disappointment in viewing it.

If the *bridge* be equally high throughout, the arches, being all of a height, are made all of a size, which causes a great saving of centering. If the *bridge* be higher in the middle than at the ends, let the arches decrease from the middle towards each end, but so that each half have the arches exactly alike, and that they decrease in span proportionally to their height, so as to be always the same kind of figure. *Bridges* should rather be of few and large arches, than of many and small ones, if the height and situation will allow of it.

Names of all the terms peculiar to BRIDGES, &c.

Abutment. See **Butments**.

Arch, an opening of a bridge, through or under which the water, &c. passes, and which is supported by piers or butments. *Arches* are denominated circular, elliptical, cycloidal, catenarian, equilibrial, gothic, &c. according to their figure or curve.

Archivolt, the curve or line formed by the upper sides of the vouffoires or arch-stones. It is parallel to the intrados or under side of the arch when the vouffoires are all of the same length; otherwise not.

By the *archivolt* is also sometimes understood the whole set of vouffoires.

Banquet, the raised foot-path at the sides of the bridge next the parapet: it is generally raised about a foot above the middle or horse-passage, and 3, 4, 5, 6, or 7, &c. feet broad, according to the size of the bridge, and paved with large stones, whose length is equal to the breadth of the walk.

Battardeau, or } a case of piling, &c. without

Coffer-dam, } a bottom, fixed in the bed of the river, water-tight or nearly so, by which to lay the bottom dry for a space large enough to build the pier on. When it is fixed, its sides reaching above the level of the water, the water is pumped out of it, or drawn off by engines, &c. till the space be dry; and it is kept so by the same means, until the pier is built up in it, and then the materials of it are drawn up again. *Battardeaux* are made in various manners, either by a single inclosure, or by a double one, with clay or chalk rammed in between the two, to prevent the water from coming through the sides: and these inclosures are also made either with piles only, driven close by one another, and sometimes notched or dove-tailed into each other; or with piles grooved in the sides, driven in at a distance from one another, and boards let down between them in the grooves.

Butments, are the extremities of a bridge, by which it joins to, or abuts upon, the land, or sides of the river, &c.

These must be made very secure, quite immoveable, and more than barely sufficient to resist the drift of its adjacent arch; so that, if there are not rocks or very solid banks to raise them against, they must be well re-inforced with proper walls or returns, &c.

Caisson, a kind of chest, or flat-bottomed boat, in which a pier is built, then sunk to the bed of the river, and the sides loosened and taken off from the bottom, by a contrivance for that purpose; the bottom of it being left under

under the pier as a foundation. It is evident therefore that the bottoms of the *caissons* must be made very strong and fit for the foundations of the piers. The *caisson* is kept afloat till the pier be built to the height of low-water mark; and for that purpose its sides must either be made of more than that height at first, or else gradually raised to it, as it sinks by the weight of the work, so as always to keep its top above water: and therefore the sides must be made very strong, and kept asunder by cross timbers within, lest the great pressure of the ambient water crush the sides in, and so not only endanger the work, but also drown the workmen within it. The *caisson* is made of the shape of the pier, but some feet wider on every side to make room for the men to work: the whole of the sides are of two pieces, both joined to the bottom quite round, and to each other at the salient angle, so as to be disengaged from the bottom, and from each other, when the pier is raised to the desired height, and sunk. It is also convenient to have a little sluice made in the bottom, occasionally to open and shut, to sink the *caisson* and pier sometimes by, before it be finished, to try if it bottom level and rightly; for by opening the sluice, the water will rush in and fill it to the height of the exterior water, and the weight of the work already built will sink it; then by shutting the sluice again, and pumping out the water, it will be made to float again, and the rest of the work may be completed; but it must not be sunk but when the sides are high enough to reach above the surface of the water, otherwise it cannot be raised and laid dry again. Mr. Labelye tells us, that the *caissons* in which he built Westminster bridge, contained above 150 load of fir timber, of 40 cubic feet each, and was of more tonnage or capacity than a 40-gun ship of war.

Centres, are the timber frames erected in the spaces of the arches to turn them on; by building on them the *voussloirs* of the arch. As the *centre* serves as a foundation for the arch to be built on, when the arch is completed, that foundation is struck from under it, to make way for the water and navigation, and then the arch will stand of itself from its curved figure. The *centre* must be constructed of the exact figure of the intended arch, convex as the arch is concave, to receive it on as a mould. If the form be circular, the curve is struck from a central point by a radius; if it be elliptical, it should be struck with a double cord, passing over two pins fixed in the focusses, as the mathematicians describe their ellipses; and not by striking dif-

ferent pieces or arcs of circles from several *centres*; for these will form no ellipsis at all, but an irregular misshapen curve made up of broken pieces of different circular arches; but if the arch be of any other form, the several abscissas and ordinates should be calculated; then their corresponding lengths, transferred to the centering, will give so many points of the curve, and exactly by which points bending a bow of pliable matter, the curve may be drawn by it.

The *centres* are constructed of beams of timber, firmly pinned and bound together, into one entire compact frame, covered smooth at top with planks or boards to place the *voussloirs* on; the whole supported by off-sets in the sides of the piers, and by piles driven into the bed of the river, and capable of being raised and depressed by wedges contrived for that purpose, and for taking them down when the arch is completed. They should also be constructed of a strength more than sufficient to bear the weight of the arch.

In taking the *centre* down, first let it down a little, all in a piece, by easing some of the wedges; then let it rest a few days to try if the arch makes any efforts to fall, or any joints open, or any stones crush or crack, &c. that the damage may be repaired before the *centre* is entirely removed, which is not to be done till the arch ceases to make any visible efforts.

Chest. See *Caisson*.

Cofferdam. See *Battardeau*.

Drift, } of an arch, is the push or force
Shoot, or } which it exerts in the direction of
Thrust, } the length of the bridge. This force arises from the perpendicular gravitation of the stones of the arch, which being kept from descending by the form of the arch, and the resistance of the pier, exert their force in a lateral or horizontal direction. This force is computed in *Prop. 10*, of Mr. Hutton's *Principles of Bridges*, where the thickness of the pier is determined that is necessary to resist it, and is greater the lower the arch is, *ceteris paribus*.

Elevation, the orthographic projection of the front of a bridge, on the vertical plane, parallel to its length. This is necessary to show the form and dimensions of the arches and other parts, as to height and breadth, and therefore has a plain scale annexed to it, to measure the parts by. It also shows the manner of working up and decorating the fronts of the bridge.

Extrados, the exterior curvature or line of an arch. In the propositions of the second section in Professor Hutton's *Principles of Bridges*, it is the outer or upper line of the wall above the arch;

arch; but it often means only the upper or exterior curve of the vouffoirs.

Foundations, the bottoms of the piers, &c. or the bases on which they are built. These bottoms are always to be made with projections, greater or less, according to the spaces on which they are built: and according to the nature of the ground, depth and velocity of water, &c. the foundations are laid and the piers built after different manners, either in caissons, in battardeaux, on stilts with sterlings, &c. for the particular method of doing which, see each under its respective term.

The most obvious and simple method of laying the *foundations* and raising the piers up to the water-mark, is to turn the river out of its course above the place of the bridge, into a new channel cut for it near the place where it makes an elbow or turn; then the piers are built on dry ground, and the water turned into its old course again, the new one being securely banked up. This is certainly the best method, when the new channel can be easily and conveniently made; but which however is seldom or never the case.

Another method is, to lay only the space of each pier dry 'till it be built, by surrounding it with piles and planks driven down into the bed of the river, so close together as to exclude the water from coming in; then the water is pumped out of the inclosed space, the pier built in it, and lastly the piles and planks drawn up. This is coffer-dam work, but evidently cannot be practised if the bottom be of a loose consistence, admitting the water to ooze and spring up through it.

When neither the whole nor part of the river can be easily laid dry as above, other methods are to be used; such as to build either in caissons or on stilts, both which methods are described under their proper words; or yet by another method, which hath, though seldom, been sometimes used, without laying the bottom dry, and which is thus: the pier is built upon strong rafts or gratings of timber, well bound together, and buoyed up on the surface of the water by strong cables, fixed to the other floats or machines, 'till the pier is built; the whole is then gently let down to the bottom, which must be made level for the purpose: but of these methods, that of building in caissons is the best.

But before the pier can be built in any manner, the ground at the bottom must be well secured, and made quite good and safe, if it be

not so naturally. The space must be bored into, to try the consistence of the ground; and if a good bottom of stone, or firm gravel, clay, &c. be met with, within a moderate depth below the bed of the river, the loose sand, &c. must be removed and digged out to it, and the foundation laid on the firm bottom on a strong grating or base of timber made much broader every way than the pier, that there may be the greater base to press on, to prevent its being sunk; but if a solid bottom cannot be found at a convenient depth to dig to, the space must then be driven full of strong piles, whose tops must be sawed off level some feet below the bed of the water, the sand having been previously digged out for that purpose; and then the foundation on a grating of timber laid on their tops as before: or, when the bottom is not good, if it be made level, and a strong grating of timber, 2, 3, or 4 times as large as the base of the pier be made, it will form a good base to build on, its great size preventing it from sinking. In driving the piles, begin at the middle, and proceed outwards all the way to the borders or margin; the reason of which is, that if the outer ones were driven first, the earth of the inner space would be thereby so jammed together, as not to allow the inner piles to be driven: and besides the piles immediately under the piers, it is also very prudent to drive in a single, double, or triple row of them around, and close to the frame of the *foundation*, cutting them off a little above it, to secure it from slipping aside out of its place, and to bind the ground under the pier firmer: for, as the safety of the whole bridge depends on the *foundation*, too much care cannot be used to have the bottom made quite secure.

Jettee, the border made round the stilts under a pier. See *Sterling*.

Impost, is the part of the pier on which the feet of the arches stand, or from which they spring.

Key-stone, the middle vouffoir, or the arch-stone in the top or immediately over the centre of the arch. The length of the *key-stone*, or thickness of the archivolt at top, is allowed to be about 1-15th or 1-16th of the span by the best architects.

Orthography, the elevation of a bridge, or front view, as seen at an infinite distance.

Parapet, the breast-wall made on the top of a bridge to prevent passengers from falling over. In good bridges, to build the parapet but

but a little part of its height close or solid, and upon that a balustrade to above a man's height, has an elegant effect.

Piers, the walls built for the support of the arches, and from which they spring as their bases. They should be built of large blocks of stone, solid throughout, and cramped together with iron, which will make the whole as one solid stone. Their faces or ends, from the base up to high-water mark, should project sharp out with a salient angle, to divide the stream: or, perhaps the bottom of the pier should be built flat or square up to about half the height of low-water mark, to allow a lodgement against it for the sand and mud, to go over the foundation; lest, by being kept bare, the water should in time undermine, and so ruin or injure it. The best form of the projection for dividing the stream, is the triangle; and the longer it is, or the more acute the salient angle, the better it will divide it, and the less will the force of the water be against the pier; but it may be sufficient to make that angle a right one, as it will make the work stronger; and in that case the perpendicular projection will be equal to half the breadth or thickness of the pier. In rivers, on which large heavy craft navigate and pass the arches, it may perhaps be better to make the ends semicircular; for, although it does not divide the water so well as the triangle, it will both better turn off and bear the shock of the craft.

The thickness of the *piers* should be such as will make them of weight or strength sufficient to support their interjacent arch independent of any other arches; and then, if the middle of the *pier* be run up to its full height, the centering may be struck to be used in another arch before the hanches are filled up. The whole theory of the *piers* may be seen in the third section of Professor Hutton's *Principles of Bridges*.

They should be made with a broad bottom on the foundation, and gradually diminishing in thickness by off-sets up to low-water mark.

Piles, are timbers driven into the bed of the river for various purposes, and are either round, square, or flat like planks. They may be of any wood which will not rot under water; but oak and fir are mostly used, especially the latter, on account of its length, straightness, and cheapness. They are shod with a pointed iron at the bottom, the better to penetrate into the ground, and are bound with a strong iron-band or ring at top, to prevent them from being split by violent strokes of the ram by which they are driven down.

Piles are either used to build the foundations on, or they are driven about the pier as a border of defence, or to support the centres on; and in this case, when the centering is removed, they must either be drawn up, or sawed off very low under water; but it is perhaps better to saw them off and leave them sticking in the bottom, lest the drawing of them out should loosen the ground about the foundation of the pier. Those to build on, are either such as are cut off by the bottom of the water, or rather a few feet within the bed of the river; or else such as are cut off at low-water mark, and then they are called stilts. Those to form borders of defence, are rows driven in close by the frame of a foundation, to keep it firm, or else they are to form a case or jettée about the stilts, to keep the stones within it, that are thrown in to fill it up: in this case the *piles* are grooved, driven at a little distance from each other, and *plank-piles* let into the grooves between them, and driven down also, 'till the whole space is surrounded. Besides using this for stilts, it is sometimes necessary to surround a stone pier with a sterling, or jettée, and fill it up with stones to secure an injured pier from being still more damaged, and the whole bridge ruined. The *piles* to support the centres may also serve as a border of piling to secure the foundation, cutting them off low enough after the centre is removed.

Pile-driver, an engine for driving down the piles. It consists of a large ram or iron sliding perpendicularly down between two guide-posts; which being lifted up to the top of them, and there let fall from a great height, comes down upon the top of the pile with a violent blow. It is worked either with men or horses, and either with or without wheel-work. That which was used at the building of Westminster bridge, is perhaps the best ever invented.

Pitch, of an arch, the perpendicular height from the spring or impost to the key-stone.

Plan, of any part, as of the foundations, or piers, or superstructure, is the orthographic projection of it on a plane parallel to the horizon.

Push, of an arch. See *Drift*.

Salient angle, of a pier, the projection of the end against the stream, to divide it. The right-lined angle best divides the stream, and the more acute, the better for that purpose; but the right angle is generally used, as making the best masonry. A semicircular end, though it does not divide the stream so well, is sometimes better in large navigable rivers, as it carries the craft the better off, or bears their shocks the better.

Shoot,

Shoot, of an arch. See *Drift*.

Springers, are the first or lowest stones of an arch, being those at its feet, bearing immediately on the impost.

Sterlings, or *Jetties*, a kind of case made about a pier of stilts, &c. to secure it, and is particularly described under the next word, *Stilts*.

Stilts, a set of piles driven into the space intended for the pier, whose tops being sawed level off, above low-water mark, the pier is then raised on them. This method was formerly used when the bottom of the river could not be laid dry; and the *stilts* were surrounded, at a few feet distance, by a row of piles and planks, &c. close to them like a coffer-dam, and called a *sterling*, or *jettie*; after which loose stones, &c. are thrown or poured down into the space, 'till it is filled up to the top, by that means forming a kind of pier of rubble or loose work, and which is kept together by the sides or *sterlings*: this is then paved level at the top, and the arches turned upon it. This method was formerly much used, for most of the large old bridges in England being erected that way, such as London bridge, Newcastle bridge, Rochester bridge, &c. But the inconveniences attending it are so great, that it is now quite disused: for, because of the loose composition of the piers, they must be made very large or broad, or else the arch must push them over, and rush down as soon as the centre was drawn; which great breadth of piers and *sterlings* so much contracts the passage of the water, as not only very much incommodes the navigation through the arch, from the fall and quick motion of the water; but from the same cause also the bridge itself is in much danger, especially in time of floods, when the water is too much for the passage. Add to this, that besides the danger there is of the pier bursting out the *sterlings*, they are also subject to much decay and damage by the velocity of the water and the craft passing through the arches.

Thrust. See *Drift*.

Vousoirs, the stones which immediately form the arch, their undersides constituting the intrados. The middle one, or key-stone, should be about 1-15th or 1-16th of the span, as has been observed; and the rest should increase in size all the way down to the impost: the more they increase the better, as they will the better bear the great weight which rests upon them without being crushed; and also will bind the firmer together. Their joints should also be cut perpendicular to the curve of the intrados.

For more information see Professor Hutton's *Principles of Bridges*, Newcastle, 1772, in 8°.

* *BRIGANDINE*, in *ancient military history*, a coat of mail, or kind of ancient defensive armour, consisting of tin.

BUCKLER, in *antiquity*, a piece of defensive armour used by the ancients. It was always worn on the left arm, and composed of wicker-work, of the lightest sort, but most commonly of hides, fortified with plates of brass or other metals. The shape of it varied considerably, being sometimes round, sometimes oval, and often nearly square.

BUDGE-barrels. See *BARRELS*, in the first Alphabet.

BUFF. See *BELTS*, in the first Alphabet.

* *BUILDING*, in a *general sense*, a fabric erected by art, either for devotion, magnificence, or conveniency.

Military BUILDINGS, are of various sorts, viz. powder-magazines, bridges, gates, barracks, hospitals, store-houses, guard-rooms, &c.

Regular BUILDING, is that whose plan is square, the opposite sides equal, and all the parts disposed with symmetry.

Irregular BUILDING, that whose plan is not contained within equal or parallel lines, either by the accident of situation, or the design of the builder, and whose parts are not relative to one another in the elevation.

Insulated BUILDING, that which is not contiguous to any other, but is encompassed with streets, open squares, or the like.

Engaged BUILDING, one surrounded with other buildings, having no front to any street or public place, nor any communication without, but by a common passage.

Interred or sunk BUILDING, one whose area is below the surface of the place where it stands, and of which the lowest courses of stone are concealed.

In *building* there are three things to be considered, viz. first, commodity or conveniency; secondly, firmness or stability; thirdly, delight.

To accomplish which ends, Sir Henry Wotton considers the whole subject under two heads, namely, the seat or situation, and the work.

1. As for the seat, either that of the whole is to be considered, or that of its parts.

2. As to the situation, regard is to be had to the quality, temperature, and salubrity or healthiness of the air; that it be a good healthy air, not subject to foggy noisomeness from adjacent fens or marshes; also free from noxious mineral exhalations; nor should the place want the

the sweet influence of the sun-beams, nor be wholly destitute of the breezes of wind, which will fan and purge the air; the want of which would render it like a stagnated pool, and would be very unhealthy.

In the foundations of *buildings*, Vitruvius orders the ground to be dug up, to examine its firmness; that an appearing solidity is not to be trusted, unless the whole mould cut through be found and solid: 'tis true, he does not say to what depth it should be dug; but Palladio determines it to be a sixth part of the height of the building.

The great laws of walling are, 1. That the walls stand perpendicular on the ground-work, the right angle being the foundation of all

stability. 2. That the largest and heaviest materials be the lowest, as more proper to sustain others than be sustained themselves. 3. That the work diminish in thickness, as it rises, both for the ease of weight and expence. 4. That certain courses, or lodges, of more strength than the rest, be interlaid, like bones, to sustain the wall from total ruin, if some of the under parts chance to decay. 5. Lastly, that the angles be firmly bound, they being the nerves of the whole fabric; which are sometimes fortified on each side the corners, even in brick buildings, with square stones; which add both beauty and strength. See STONE, BRICKS, LIME, SAND.

C

* **C E M E N T**, } *among engineers*, a strong sort
C E M E N T, } of mortar, used to bind
 bricks or stones together for some kind of mouldings; or in cementing a block of bricks for the carving of capitals, scrolls, or the like. There are two sorts, i. e. hot *cement*, which is the most common, made of resin, bees-wax, brick-duft, and chalk, boiled together. The bricks to be cemented with this mixture, must be made hot in the fire, and rubbed to and fro after the *cement* is spread, in the same manner as joiners do when they glue two boards together. Cold *cement*, made of Cheshire cheese, milk, quick lime, and whites of eggs. This *cement* is less used than the former, and is accounted a secret known but to very few bricklayers.

* **CÆSTUS**, in *military antiquity*, a kind of large gauntlet, composed of raw hides, used by wrestlers at the public games.

CAIMACAN, in *military history*, an officer among the Turks, nearly answering to our lieutenant.

CAMP. See the first Alphabet.

The arrangement of the tents in *camp*, is nearly the same all over Europe, which is, to dispose them in such a manner, that the troops may form with safety and expedition.

To answer this end, the troops are encamped in the same order as that in which they are to engage, which is by battalions and squadrons; hence, the post of each battalion and squadron

in the line of battle, must necessarily be at the head of its own encampment. Gustavus Adolphus, king of Sweden, was the first who formed encampments according to the order of battle.

By this disposition, the extent of the *camp* from right to left, of each battalion and squadron, will be equal to the front of each in line of battle; and consequently, the extent from right to left of the whole *camp*, should be equal to the front of the whole army when drawn up in line of battle, with the same intervals between the several encampments of the battalions and squadrons, as are in the line.

There is no fixed rule for the intervals: some will have no intervals, some small ones, and others are for intervals equal to the front of the battalion or squadron. The most general method is, an interval of 60 feet between each battalion, and of 36 feet between each squadron.

Hence it follows, 1st, That the front line of the *camp* be in a direction to face the enemy; 2^{dly}, That at the head of the encampment of each battalion and squadron, there must be a clear space of ground, on which they may form in line of battle; and 3^{dly}, That when the space taken up by the army is embarrassed with woods, ditches, and other obstructions, a communication must be opened for the troops to move with ease to the assistance of each other.

The *camps* of the Greeks and Romans were either round, square, or oval, or rather of an oblong square, with the sharp corners taken off; and to secure them against surprises, it was the prevailing custom to surround them with intrenchments. The *camps* of the Anglo-Saxons and Danes were generally round, as likewise those of the Anglo-Normans. The *camps* of the ancient Britons were of an oval form, composed of stakes, earth, and stones, rudely heaped together: but the practice of the present times is quite different; for the security of our *camps*, whose form is a rectangle, consists in being able to draw out the troops with ease and expedition at the head of their respective encampments.

CAMP of a battalion of infantry, is the ground on which they pitch their tents and lodges.

The principal object in the arrangement of a *camp* is, that both officers and men may repair with facility and expedition to the head of the line; for which reason the tents are placed in rows perpendicular to the front of the camp, with spaces between them, called streets. The general method is, to form as many rows of tents as there are companies in the battalion; those for the private men in the front, and those for the officers in the rear. See Pl. VIII.

The several companies of a battalion are posted in camp, in the same manner as in the line of battle; that is, the company of grenadiers on the right, and that of light-infantry on the left; the colonel's company on the left of the grenadiers, the lieutenant-colonel's on the right of the light-infantry, the major's on the left of the colonel's, the eldest captain's on the right of the lieutenant-colonel's; and so on from right to left, 'till the two youngest companies come into the centre.

The battalion companies are posted two by two; that is, the tents of every two of these companies are ranged close together, to obtain, though fewer, larger and more commodious streets: the entrances of all the companies tents face the streets, except the first tent of each row belonging to the serjeants, which faces the bells of arms and front of the camp.

The number of tents in each perpendicular row, is regulated by the strength of the companies, and the number of men allowed to each tent, which at present is 5 men: thence it follows, that a company of 60 men will require 12 tents, a company of 75 men 15 tents, and a company of 100 men 20 tents; but as it always happens that some are on duty, fewer tents may serve in time of necessity.

When the battalion is in the first line of en-

campment, the privies are opened in the front, and at least 150 feet beyond the quarter-guard; and when in the second line, they are opened in the rear of that line.

To distinguish the regiments, camp colours are fixed at the flanks, and at the quarter and rear guard.

The colours and drums of each battalion are placed at the head of its own grand street, in a line with the bells of arms of the several companies. The officers esponsos are placed at the colours, with the broad part of their spears to the front. The serjeants halberts are placed between, and on each side of the bells of arms, with their hatchets turned from the colours.

When two field-pieces are allowed to each battalion, they are posted to the right of it. Gustavus Adolphus, king of Sweden, was the first who ordered two field-pieces to each battalion, which are generally light 6-pounders.

Distribution of the front and depth of the CAMP for a battalion of infantry. The present mode of encampments differs from what they formerly were. The front of the *camp* for a battalion of 10 companies of 60 men each, is at present 400 feet, and during the late wars only 360 feet; the depth at present 759 feet, and during the late war 960. The front of the *camp* of a battalion of 10 companies of 100 men each is at present 668 feet, and formerly only 592; the depth 759 feet, formerly 960. The breadth of the streets from 45 to 55 feet, excepting the main street, which is sometimes from 60 to 90 feet broad.

Of the CAMP of a battalion by a new method. This is, by placing the tents in 3 rows parallel to the principal front of the *camp*; that is, suitable to the 3 ranks in which the battalion is drawn up: the tents of the first row, which front the *camp*, are for the men of the front rank: the tents of the second row front the rear, and are for the men of the second rank; and the tents of the third row, which front the centre row, are for the men of the rear rank.

CAMP of cavalry. The tents for the cavalry, as well as for the infantry, are placed in rows perpendicular to the principal front of the *camp*; and their number is conformable to the number of troops. The horses of each troop are placed in a line parallel to the tents, with their heads towards them. See Pl. IX.

The number of tents in each row, is regulated by the strength of the troops, and the number of troopers allotted to each tent is 5: it follows that a troop of 30 men will require 6 tents, a troop of 60 men 12 tents, and a troop

troop of 100 men 20 tents. The tents for the cavalry are of the same form as those of the infantry, but more spacious, the better to contain the fire-arms, accoutrements, saddles, bridles, boots, &c. See TENTS.

Distribution of the front and depth of a CAMP of cavalry. Supposing the regiment to consist of 2 squadrons, of 3 troops each, and of 50 men in each troop, the extent of the front will be 450 feet, if drawn up in 2 ranks; but if drawn up in 3 ranks, the front will be only 300 feet, the depth 220, and the breadth of the back streets 30 feet, and the other streets 46 feet each. In the last war 600 feet were allowed each regiment of cavalry in front, 774 feet for the depth, and the breadth of the streets as above.

The standard-guard tents are pitched in the centre, in a line with the quarter-master's. The camp colours of the cavalry are also of the same colour as the facing of the regiment, with the rank of the regiment in the centre: those of the horse are square, like those of the foot; and those of the dragoons are swallow-tailed. The dung of each troop is laid up behind the horses. See Pl. IX.

CAMP duty, consists in guards, both ordinary and extraordinary: the ordinary guards are relieved regularly at a certain hour every day (generally about 9 or 10 o'clock in the morning); the extraordinary guards are all kinds of detachments commanded on particular occasions for the further security of the *camp*, for covering the foragers, for convoys, escorts, or expeditions.

The ordinary guards are distinguished into grand guards, standard, and quarter guards; rear guards, picket guards, and guards for the general officers; train of artillery, bread waggons, pay-master general, quarter-master general, majors of brigade, judge advocate, and provost marshal. See GUARDS, in the first Alphabet.

The number and strength of the grand guards and out-posts, whether of cavalry or infantry, depend on the situation of the *camp*, nature of the country, and the position of the enemy. The strength of general officers guards is limited. See HONOURS, in the first Alphabet.

CAMP maxims, are, 1. The principal rule in forming a *camp*, is to give it the same front the troops occupy in order of battle.

2. The method of encamping is by battalions and squadrons, except the royal regiment of artillery, which is encamped on the right

and left of the park of artillery. See ARTILLERY PARK, and *Encampment of a regiment of artillery*, in the first Alphabet.

3. Each man is allowed 2 feet in the ranks of the battalion, and 3 feet in the squadron: thence the front of a battalion of 900 men, formed 3 deep, will be 600 feet; and the front of a squadron of 150 men, formed 2 deep, will be 225 feet.

4. The depth of the *camp* when the army is encamped in 3 lines, is at least 2750 feet; that is, 750 feet for the depth of each line, and 250 feet for the space between each of those lines.

5. The park of artillery should always be placed on a dry rising ground, if any such situation offers; either in the centre of the front line, or in the rear of the second line; with all the train horses encamped in the rear of the park. See Pl. II.

6. The bread-waggons should be stationed in the rear of the *camp*, and as near as possible to the centre, that the distribution of the bread may be rendered easy.

7. When the commander in chief encamps, it is generally in the centre of the army; and the town or village chosen for his residence is called head quarters.

8. That general is inexcusable, who, for his own personal accommodation, makes choice of quarters that are not properly secured, or at too great a distance to have an easy communication with the *camp*.

9. If the ground permits, the troops should be encamped as near to good water as possible.

10. When there are hussars, they are generally posted near the head quarters, or in the front of the army.

11. The ground taken up by the encampment of an army, should be equally distributed, and, if possible, in a straight line; for then the whole will have more grace: for a crooked line, and an inequality of disposition, afford a very unpleasing view both of the *camp*, and of the troops when they are under arms.

12. Cleanliness is essentially necessary to the health of a *camp*, especially when it is to remain for any length of time. To maintain this, the privies should be often filled up, and others opened; at least every 6 days. The offal of cattle, and the carcases of dead horses, should be buried very deep; and all kinds of corrupt effluvia, that may infect the air and produce epidemical disorders, should be constantly removed.

Choice of CAMPS. 1. At the beginning of

a campaign, when the enemy is at too great a distance to occasion any alarm, all situations for *camps* that are healthy are good, provided the troops have room, and within reach of water, wood, and provisions. More ground should be allowed to the troops in *camps* of duration, than in temporary ones.

2. *Camps* should be situated as near as possible to navigable rivers, to facilitate the conveyance of all manner of supplies; for convenience and safety are the principal objects for *camps*.

3. A *camp* should never be placed too near heights, from whence the enemy may overlook it; nor too near woods, from whence the enemy may surprise it. If there are eminences, not commanded by others, they should be taken into the *camp*; and when that cannot be done, they should be fortified.

4. The choice of a *camp* depends in a great measure on the position of the enemy, on its strength, and on the nature and situation of the country.

5. A skilful general will avail himself of all the advantages for a *camp*, which nature may present, whether in plains, mountains, ravins, hollows, woods, lakes, inclosures, rivers, rivulets, &c.

6. The disposition of the troops in *camp* should depend on the nature and situation of the ground; as there are occasions which require all the infantry to encamp on the right, and the cavalry on the left; and there are others which require the cavalry to form in the centre, and the infantry on the wings.

7. A *camp* should never be formed on the banks of a river, without a space of at least 2 or 3000 feet, for drawing out the army in order of battle: the enemy cannot then easily alarm the *camp*, by artillery and small arms from the other side.

8. *Camps* should never be situated near rivers that are subject to be overflowed, either by the melting of the snow, or by accidental torrents from the mountains. Marshy grounds should also be avoided, on account of the vapours arising from stagnant water, which infect the air.

9. On the choice of *camps* and posts, frequently depends the success of a campaign, and even sometimes of a war.

Camp guards. They are of two sorts; the one serve to maintain good order within the *camp*; and the other, which are stationed without the *camp*, serve to cover and secure it against the enemy. These guards are formed of both

infantry and cavalry; and in proportion to the strength of the army, situation of the *camp*, and disposition of the enemy, some require that these guards should consist of the 8th part of the army; others, of the 3d part; and when an attack from the enemy is apprehended, even of the half.

Manner of stationing the CAMP guards. It is of the utmost consequence to station the guards in such places, as may enable them to discover easily whatever approaches the *camp*.

2. The guards of the cavalry are generally removed further from the *camp*, than those of the infantry; but never at so great a distance, as to endanger their being cut off: within cannon-shot is a very good distance. They are often stationed in highways, in open places, and on small heights; but, however, so disposed, as to see and communicate with one another.

3. The vedettes to the out-posts should be double; for, should they make a discovery, one may be detached to inform the officer commanding the out-post, and the other remain on duty: they should not be at too great a distance from their detachment; probably, about 50 or 60 paces is enough.

4. The guards of infantry have different objects, and are differently stationed: their duty is, to receive and support the guards of cavalry in case of need; to protect the troops sent out for wood, forage, or water; in short, to prevent any approaches from the small parties of the enemy. Some are stationed in the churches of the neighbouring villages, in castles, houses, and in passages and avenues of woods; others are stationed on the borders of rivulets, and in every place necessary to secure the *camp*. Guards that are stationed in churches, steeples, trees, castles, and houses, should if possible be seen from the army, or at least from some grand guard in its neighbourhood, that signals may be seen and repeated.

5. The guards of infantry are generally fixed; that is, they have the same post both day and night, except such as are to support and protect the guards of cavalry, and to cover the forage grounds. All out-guards should have intrenching-tools with them.

6. The guards of cavalry have generally a day post and a night post; the latter is seldom more than 4 or 500 paces from the *camp*; one third should be mounted, one third bridled, and one third feeding their horses; but when near the enemy, the whole guard should be kept mounted during the night.

7. The

7. The security and tranquillity of a *camp* depending upon the vigilance of the guards, the officers who command them cannot be too active in preventing surprises: a neglect in this particular is often of fatal consequence. Though an officer should, at all times, be strictly attentive to every part of the service, yet he should be more particularly watchful in the night than in the day. The night is the time most favourable for surprises; as those who are not on duty, are generally asleep, and cannot immediately afford assistance; but in the day time, the attention of all the troops is turned to the movements of the enemy; they are sooner under arms, sooner in readiness to march, and in much less danger of being thrown into confusion. Those who wish to be better acquainted with the nature and mode of encampments, may read Mr. Lochée's useful *Essay on Castrametation*. *

Concerning the healthiness of the different seasons of a campaign, the ingenious Dr. Pringle has the following observations. The first 3 weeks is always sickly; after which the sickness decreases, and the men enjoy a tolerable degree of health throughout the summer, unless they get wet clothes. The most sickly part of the campaign is towards the end of August, whilst the days are still hot, but the nights cold and damp with fogs and dews; then, if not sooner, the dysentery prevails; and though its violence is over by the beginning of October, yet the remitting fever, gaining ground, continues throughout the rest of the campaign, and never entirely ceases, even in winter quarters, 'till the frost begins. He likewise observes, that the last 14 days of a campaign, if protracted 'till the beginning of November, is attended with more sickness than the two first months of the encampment. As to winter expeditions, though severe in appearance, he tells us, they are attended with little sickness, if the men have strong and good shoes, warm quarters, fuel, and provisions enough.

CANNONADE, in *artillery*, may be defined the application of artillery to the purposes of

a land war, or the direction of its efforts against some distant object intended to be seized or destroyed, as the troops in battle, battery, fortrefs, or out-work.

Cannonading is therefore used from a battery, to take, destroy, burn, or drive the enemy from the defences, &c. and to batter and ruin the works or fortified towns.

CANNON. See this word in the first Alphabet.

Dimensions of all sorts of brass CANNON, as established by the board of ordnance in 1764.

Nature		Pdrs.	Length		Weight		Calibre of the gun		Diam. of the shot	
			F. in.	C.	q.	lb.	in.	hun.	in.	hun.
Brass guns	Heavy	42	9	6	61	0	0	7.3		6.68
		24	9	6	52	0	0	5.83		5.54
		12	9	0	29	0	0	4.63		4.40
		9	9	0	26	0	0	4.21		4.0
		6	8	0	19	0	0	3.66		3.48
		3	7	0	11	2	0	2.91		2.77
	Mediums	1½	6	0	5	2	0	2.31		2.20
		24	8	0	40	1	21	5.83		5.54
		12	6	6	21	0	14	4.63		4.40
		6	5	0	10	1	0	3.66		3.48
	Light	24	5	6	16	1	12	5.83		5.54
		12	5	0	8	3	18	4.63		4.40
		6	4	6	4	3	14	3.66		3.48
		3	3	6	2	3	4	2.91		2.77

* This gentleman keeps a military academy at Little Chelsea, where youth are well instructed in the military sciences and discipline, requisite for the infantry and cavalry. He is deservedly patronised by his Majesty, and his mode of education has met with the approbation of the most skilful officers.

C A N

A R

Dimensions of all sorts of iron CANNON, established, 1764.

Nature	Pdrs.	Length			Weight			Calibre of the gun		Diam. of the shot	
		F. in.	C.	q.	lb.	in.	hun.	in.	hun.	in.	hun.
Iron guns		42	9	6	65	0	0	7.3		6.68	
		32	9	6	55	0	0	6.42		6.10	
		24	9	6	49	0	0	5.83		5.54	
		24	9	6	47	2	0	5.83		5.54	
		18	9	0	40	0	0	5.29		5.3	
		12	9	0	32	2	0	4.63		4.40	
		12	8	6	31	2	0	4.63		4.40	
		12	7	6	29	1	0	4.63		4.40	
		9	9	0	29	0	0	4.21		4.0	
		9	8	6	27	2	0	4.21		4.0	
		9	8	0	26	2	0	4.21		4.0	
		9	7	6	24	2	0	4.21		4.0	
		9	7	0	23	0	0	4.21		4.0	
		6	9	0	24	0	0	3.66		3.48	
		6	8	6	23	0	0	3.66		3.48	
		6	8	0	22	0	0	3.66		3.48	
		6	7	6	20	2	0	3.66		3.48	
		6	7	0	19	0	0	3.66		3.48	
		6	6	6	18	0	0	3.66		3.48	
		6	6	0	16	2	0	3.66		3.48	
		4	6	0	12	1	0	3.21		3.4	
		4	5	6	11	1	0	3.21		3.4	
		3	4	6	7	1	0	2.91		2.77	
		1	3	0	1	1	25	1.58		1.52	

To lay a CANNON to a given object. First find the centre of metal by the perpendicular, then apply your two fore fingers to the base centre, and look behind them until you make the muzzle centre cut the centre of the object; then the piece is properly directed. Secondly, having determined upon the necessary elevation, place the centre of the quadrant in the bore, and elevate or depress the piece 'till the plummet cuts the required elevation; and the piece is laid.

When the object fired at cannot be seen from the battery, which is often the case with mortars, proceed thus for the direction. Ascend the nearest ground in a line between the battery and object, from whence you can see them both, and place 2 pickets in such a direction as to cut each mortar and the object it is to be fired at; then make the centres of metal of each mortar cut its proper picket, and it will be properly laid.

CARCASSES. See the first Alphabet.

COMPOSITION for each nature of CARCASSES.

Corned powder 30 lb. Swedish pitch 12 lb. falt-petre 6 lb. and tallow 3 lb. The corned powder and falt-petre to be well mixed together; the pitch and tallow to be made hot over the fire, and put into another pan; then mixed with the corned powder and falt-petre; and lastly, mix them well together for use. When old, they are to be primed with fuze composition.

Weight of new oblong hammered CARCASSES, established the 22d of April, 1759.

Diam.	When empty	Coated	Filled	Woulded	Primed	Kirted
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
10-inch	33 0	33 10	64 14	69 8	70 4	71 2
8-inch	15 12	16 1	32 14	33 2	33 10	34 0
5½-in.	1 8	1 10	8 6		8 9	8 12
4½-in.	1 2	1 4	4 9		4 10	4 12

Dimensions and weight of round CARCASSES, as established the 2d of August, 1760.

Natures	Diameter of the carcass		Diameter of the holes				Distance of each hole		Thicknefs of metal		
	Exterior	Interior	The top hole		In the sides		From the top hole	In the sides one fr. anoth.	Of each of the holes	At the bot. of the carcass	Weight
			at top	at bot- tom	at top	at bot- tom					
	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	c. q. lb.
5 holes	12.75	8.20	3.40	3.4	2.40	2. $\frac{3}{10}$	6.20	7.0	2.0	2.55	1 2 14
4 holes	12.75	8.0	3.50	3.30	2.50	2.20	6.20	10.85	2.0	3.0	1 2 26
3 holes	12.75	7.50	4.0	3.80	2.80	2.60	6.20	12.0	2.0	3.25	1 3 4

* **CAR**, in *military antiquity*, a kind of small carriage; figuratively, used by the poets for a chariot: it is mounted on wheels, representing a stately throne, used in triumphs and on other solemn occasions.

* **CARIPI**, in *military history*, a kind of cavalry in the Turkish army, which to the number of 1000 are not slaves, nor bred up in the seraglio, like the rest, but are generally Moors, or renegado Christians, arrived to the rank of horse-guards to the Grand Signior.

CARTOUCHES, in *artillery*, are made of leather, to sling over the shoulder of the matross, who therein carries the ammunition from the magazine or waggon, for the service of the artillery, when at exercise or on real service.

* **CASTRAMETATION**, in the *art of war*, is the art of measuring or tracing out the form of a camp on the ground; yet it sometimes has a more extensive signification, by including all the views and designs of a general; the one requires only a mathematician, the other an experienced foldier. The ancients were accustomed to fortify their camps by throwing up intrenchments round them. The Turks, and other Asiatic nations, fortify themselves, when in an open country, with their waggons and other carriages. The practice of the Europeans is quite different; for the surety of their camp consists in the facility and convenience of drawing out their troops at the head of their encampment; for which reason, whatever particular order of battle is regarded as the best disposition for fighting, it follows of course, that we should encamp in such a manner as to assemble and parade our troops in that order and disposition as soon as possible. It is there-

fore the order of battle that should regulate the order of encampment; that is to say, the post of each regiment in the line of battle should be at the head of its own encampment; from whence it follows, that the extent of the line of battle from right to left of the camp, should be equal to the front of the troops in line of battle, with the same intervals in the camp as in the line. By this means every battalion covers its own tents, and they can all lodge themselves, or turn out in case of necessity, at a minute's warning.

If the front of the camp is greater than the line, the troops must leave large intervals, or expose their flanks; if less, the troops will not have room to form with the proper intervals.

The front or principal line of the camp is commonly directed to face the enemy. See **CAMP**, in the first, and this Alphabet.

* **CENTESTIMATION**, in *ancient military history*, a mild kind of military punishment, in cases of desertion, mutiny, and the like, when only every 100th man is executed.

* **CIRCLE**, in *mathematics*, is a plane figure, comprehended under one line only, to which all right lines, drawn from a point in the middle of it, are equal to one another.

The angle BAC (Pl. XVI. fig. 1.) made by the tangent AB , and the chord AC , is equal to any angle AEC , or ADC , in the alternate segment AEC of the circle.

Let $ACDE$ be a quadrilateral figure in the circle, and the lines AD , EC , the diagonals, then $AC \times ED + AE \times CD = AD \times CE$.

In a circle the sine of any arch is equal to half the chord of twice that arch. The square of

the chord of any arch is equal to the rectangle under the versed sine of that arch, and the diameter of the circle. The sine of an arch is to the cosine thereof, as the radius is to the tangent of that arch. The radius is a mean proportional between the sine of an arch and the cosecant of that arch. The radius is a mean proportional between the tangent of an arch and its cotangent. As the radius is to a mean proportional between the aggregate of the radius and sine of the arch, and the difference between the radius and that sine; so is twice that sine to the sine of double that arch.

In a semi-circle, if AB (fig. 4.) be the chord of an arch, and FD the chord of $\frac{1}{2}$ the complement of that arch to a semi-circle; then will the difference between the diameter AD and the chord AB , the chord FD , and the radius AC , be continual proportionals.

The method of finding the circumference of a circle from its diameter, or radius, being given, is one of the most useful problems in geometry. The ancient method of solving this noble proposition, was to find continually the sine of half the arch, which was performed in the following manner: the sine LP being given, the cosine OP , and versed sine PN (fig. 5.) may be easily found; but $LNq = LPq + PNq$.

Wherefore $\sqrt{LPq + PNq} = LN = 2LQ$. Therefore $\frac{1}{2}LN = QN = LQ$. Now as the sine of $30^\circ =$ half the radius, the sine of 15° is had by the foregoing equation; and by repeating the operation, the sine $7^\circ 10'$ may be found; and so on continually, 'till the sine of the arch last found, its tangent, and consequently, the arch itself is expressed by the same decimal part of the radius. But as this method was attended with frequent involutions, and extractions of roots of very large numbers, the greatest mathematicians have endeavoured to find shorter and easier methods of obtaining the circle's periphery. The most direct and easy method is by the help of the infinite series.

Let C be the centre of a circle (fig. 3.) $CB = CA = r$, the radius, $AB = x$ any arch, therefore, $AD = y$, its right sine then will be CD , its cosine $= \sqrt{1 - yy}$.

Let CE be another radius of the circle infinitely near to CA , then will $EG = y$ be the fluxion of the sine AD , and the infinitely small arch $EA = x$, the fluxion of the arch AB . And from the similarity of the triangles CAD and EAG , it will be as $CD : CA ::$

$EG : EA$; that is, in species $\sqrt{1 - yy} : 1 :: y : x$. This expanded into a series, and multiplied by y , its fluent will be $y + \frac{y^3}{6} + \frac{3y^5}{40} + \frac{5y^7}{112} + \frac{35y^9}{1152} + \frac{63y^{11}}{2816}$, &c. the length of the arch

AB . Hence the length of any sine or ordinate in the circle being given, the corresponding arch may be easily found. If therefore the diameter of the circle be equal to 1. the circumference will be $3.1415, 9265, 354 +$.

The impossibility of expressing the exact proportion of the diameter of a circle to its circumference, by any received way of notation; and the absolute necessity of having it as near a quadrature as possible, has put some of the most celebrated men in all ages upon endeavouring to approximate as near as may be to the truth. The first who attempted it with success, was the elaborate Van Ceulen, a Dutchman, who by the ancient method, though so very laborious, carried it to 36 decimal places. The indefatigable Mr. Sharp carried it to 72 decimal places; and since that Mr. Machin has carried it to 100 places; and it is as follows. If the diameter of the circle be 1, the circumference will be $3.14159, 26535, 89793, 23846, 26433, 83279, 50283, 41971, 61399, 37510, 58209, 74944, 59230, 78164, 05286, 20899, 86280, 34325, 34211, 70679, +$, of the same parts; which is a degree of exactness far surpassing all imagination.

But the ratio's generally used in practice are as 7 to 22; as 106 to 333; 113 to 355; as 1702 to 5347; as 1815 to 5702; or as 1 to 3.14159 .

Since, when the diameter of a circle is 1, the circumference will be $3.14159, 26536$ — of the same parts; and since all circles are similar figures, it will be,

1. As 1, to $3.14159, 26536$ —, so is the diameter of a circle to its circumference. Wherefore, if the diameter of any circle be multiplied by $3.14159, 26536$ —, the product will be the length of the circumference in the same parts.

2. As $3.14159, 26536$ — to 1, or as 1 to $.31830, 98862$ —, so is the circumference of a circle to its diameter. Wherefore, if the circumference of any circle be divided by $3.14159, 26536$ —, or multiplied by its reciprocal $.31830, 98862$ —, the former quotient, or the latter product, will give the diameter.

3. In the circle $BEGH$ (fig. 2.) put $BG = d$, or $OG = r$, then will $d = 2r$. Let A stand for the area, and c for the circumference, and suppose the arch $EG = x$ to be infinitely small, then

then will $\frac{r^2}{2}$ be the area of the infinitely small sector OFG ; this, therefore, multiplied by the whole circumference c , that is, putting c in the room of x , we shall have $\frac{r^2 c}{2} = A$, equal to the centre area of the circle.

4. Hence the area of any circle is found, by multiplying half the circumference by half the diameter or radius.

5. Hence every circle is equal to a triangle, whose base is equal to the circumference and perpendicular height of the radius.

6. Hence circles are to each other, as the squares of their respective diameters.

7. Hence, as 4 times the diameter to the circumference, so is the square of the diameter to the area.

8. Hence circles are to each other, as the squares of their radii.

9. Hence, as the diameter of a circle is to its circumference, so is the square of the radius to the area. Wherefore,

As 1, to 3.14159, 26536—, so is the square of the radius, to the area of the same circle.

10. Hence circles are to each other as the squares of their peripheries or circumferences.

11. Hence, as 4 times the circumference is to the diameter, so is the square of the circumference to the area. That is,

As 12.56637, 06144—, to 1, or as 1 to .07957, 74715; so is the square of the periphery of any circle, to its area. Wherefore, if the square of the periphery be divided by 12.56637, 06144—, or multiplied by .07957, 74715, the former quotient, or the latter product, will give its content.

CIRCLES. See GEOGRAPHY and GEOMETRY, in the first Alphabet.

COLOURS, *used in the drawings of fortification.* It is necessary to use colours in the drawings of plans and profiles of a fortification, in order to distinguish every particular part, and separate, as it were, the one from the other, so as to make their difference more sensible. The different sorts of colours, generally used in these kinds of drawings, are, *Indian-ink, carmine, verdigrease, sap-green, gum-bouch, Prussian blue, indigo, and umber.*

Indian-ink, is the first and most necessary thing required in drawing; for it serves, in drawing the lines, to express hills or rising grounds, and, in short, for all what is called shading in drawings. The best sort of *Indian-ink* is of a bluish black, soft, and easily reduced into a liquid, free from sand or gravel. It is sold in sticks from six-pence a stick to half a crown,

according to its goodness and quantity. That made in Europe is good for nothing.

The manner of liquefying it, is by putting a little clear water into a shell or tea-cup, and rubbing it gently 'till the water is black, and of a consistence much like common ink: when it is used for drawing lines, it must be made very black, though not too thick, otherwise it will not easily flow out of the drawing-pen; but when it is for shading, it must be pale, so as to go over the same shade several times, which adds a beauty to the shading.

Carmine, is an impalpable powder, and the fairest red we know of: it serves for colouring the sections of masonry, the plans of houses, and all kinds of military buildings; as likewise their elevation: but then it is made of a paler colour. It is also used for drawing red lines in plans, to represent walls. It is exceedingly dear, being generally sold for a guinea an ounce; but a little will go a great way. It must be mixed with a little gum-water.

Verdegrease, or sea-green, used in drawings, is either liquid in small vials for six-pence a piece, or mixed in little pots or shells, &c. it serves to colour wet ditches, rivers, seas, and in general to represent all watery places.

Sap-green, is a stone of a feint yellowish green, when liquefied with clear water; but when mixed with a little sea-green, it makes a beautiful grass-green; but, as all mixed colours are liable to fade, if *verd'iris* can be had, it will be much better. *Sap-green* is very cheap.

Gum-bouch, is a fine yellow in stones, and very cheap. It may be dissolved in water, but without gum: it serves to colour all projects of works; as likewise to distinguish the works unfinished from those that are so. It serves also to colour the trenches of an attack.

Indigo, is in small cakes, and very cheap; it serves to colour iron, and roofs of buildings which are covered with slates: it must be well ground upon a smooth stone or glass, and mixed with a little gum-water.

Prussian blue, is a kind of friable stone, of an exceeding fine blue: it is used to represent the colour of blue cloth in drawing encampments, battles, &c. It must be well ground, and mixed with a little gum-water.

Smalt, also a good sort of blue, and may be used for the same purposes. It is not dear.

Ultramarine, is an impalpable powder, and of a very delicate sky-blue. It is a dear colour.

Umber, is a yellowish brown colour in powder: when it is mixed with gum-water, it serves

C O M

to colour dry ditches, sand, and all kinds of earth. By mixing a little red ink with it, it will make a wood colour.

If some tobacco-leaves are steeped in clear water for several hours, and filtered through a woollen cloth, or brown paper, with a little red ink mixed with it, it will make the best earth or wood colour, as lying smoother than any other.

Gum-water, is best when it is made some time before it is used; for which reason take some *gum arabic* and steep it in clear water for some hours, 'till it is dissolved; then strain it through a woollen cloth or brown paper, and preserve it in phials, well stopped, 'till wanted.

COMMAND, in *military matters*. All *commands* fall to the eldest in the same circumstance, whether of horse, dragoons, artillery, foot, or marines. Among the officers of the corps of the British troops, entire or in parts, in case two of the same date interfere, a retrospection of former commissions, or length of service, is to be examined and ended by the judgment of the rules of war. See **COMMAND**, in the first Alphabet.

COUNTER trenches. See **SIEGE**.

COUNTER working, is the raising of works to oppose those of the enemy. See **COUNTER**, &c. in the first Alphabet.

CROSS-bar shot, in *gunnery*, shot with iron bars crossing through them, sometimes standing 6 or 8 inches out at both sides: they are used at sea, for destroying the enemy's rigging. At a siege they are of great service in destroying the enemy's palisading, &c. See **SHOT**, in the first Alphabet.

* **CROWNS**, in *ancient military history*, were of various uses and denominations, viz.

Oval Crown, *corona ovalis*, given to a general who, without effusion of blood, had conquered the enemy.

Naval Crown, *corona navalis*, distributed to those who first should board an enemy's ship.

Camp Crown, *corona castrensis*, the reward of those who first passed the palisades of, and forced an enemy's camp.

Mural Crown, *corona muralis*, the recompence and mark of honour due to those who first mounted the breach at an assault of a besieged town.

Civil Crown, *corona civica*, more esteemed than the preceding: it was the distinguishing mark of those who had saved the life of a Roman citizen in battle. It was given to Cicero for dissipating the conspiracy of Catiline, and denied to Cæsar, because he imbrued his hands in the blood of his fellow citizens.

Triumphal Crown, *corona triumphalis*, the symbol of victory, and presented to a general who gained any signal advantage to the republic.

Grass Crown, *corona graminea*, was delivered by the whole Roman people to any general who had relieved an army invested or besieged by the enemy. The other crowns were distributed by the emperors and generals; this was given to Fabius by the Roman people, for obliging Hanibal to decamp from Rome.

Olive Crown, *corona oliva*, the symbol of peace, and presented to the negotiators of it.

CUTTING-off. See **RETRENCHMENT**, in the first Alphabet.

D

DECOY, in a *military sense*, is a very diverting stratagem to carry off the enemy's horses in a foraging party, or from the pasture; to execute which, you must be disguised, and so mix on horseback in the pasture, or amongst the foragers on that side on which you propose to fly: you must then begin, by firing a few shots, which are to be answered by such of your party as are appointed to drive up the rear, and are posted at the opposite extremity of the pasture, or foraging ground; after which they are to gallop from their different stations towards the side fixed for the flight, shouting and firing all

the way: the horses being thus alarmed, and provoked by the example of others, will break loose from the pickets, throw down their riders and the trusses, and setting up a gallop, will naturally direct their course to the same side; insomuch that, if the number of them was ever so great, you might lead them in that manner for several leagues together: when you are got into some road, bordered by a hedge, or ditch, you must stop as gently as possible, and without making any noise, where the horses will suffer themselves to be taken without any opposition. It is called in French *Haraux*; and

Count

Count Saxe is the only author that mentions it.

DODECAGON, in *geometry*, is a regular figure containing 12 equal sides and angles. If the radius of a circle in which the *dodecagon* is inscribed be ± 1 , then the side of the *dodecagon* will be nearly .654; and as one is to the square of the side of any given *dodecagon*, so is 2.51956 to the area of it nearly.

* **DODECAHEDRON**, is one of the platic bodies, or five regular solids, and is contained under 12 equal and regular pentagons.

The solidity of a *dodecabedron* is found by multiplying the area of one of the pentagonal faces of it by 12; and this latter product by $\frac{1}{3}$ of the distance of the face from the centre of the *dodecabedron*, which is the same as the centre of the circumscribing sphere.

The side of a *dodecabedron* inscribed in a sphere, is the greater part of the side of a cube inscribed in that sphere, cut into extreme and mean proportion.

If the diameter of the sphere be 1.0000, the side of a *dodecabedron* inscribed in it will be .35682 nearly.

All *dodecabedrons* are similar; and are to one another as the cubes of the sides; and their surfaces are also similar, and therefore they are as the squares of their sides; whence, as .509282 is to 10.51462, so is the square of the side of any *dodecabedron* to the superficies thereof; and as .3637 is to 2.78516, so is the cube of the side of any *dodecabedron* to the solidity of it.

DUTY, in a *military sense*, is the exercise of those functions that belong to a soldier.

Regulations for doing DUTY. In all *duties*, whether with or without arms, the tour of *duty* begins with the eldest downwards. 1st. *Duties* of honour, as the king's guard, the queen's guard, the prince of Wales's guard, and the captain-general's, or field-marshal's, commanding the army. 2. Detachments of the army and out-posts. 3. General officers guards. 4. The ordinary guards, both in camp and garrison. 5. The picquets. 6. General courts-martial. 7. All kinds of *duty* called fatigues without arms.

An officer who is upon *duty*, cannot be ordered for any other before that *duty* is finished, except he be on the picquet, and then the tour of the picquet shall pass him.

If any officer's tour of *duty* for the picquet, general court-martial, or *duty* of fatigue, happen when he is on *duty*, he shall not make good such *duty* when he comes off.

Guards, or detachments, which have not marched off from the parade, are not to be reckoned as for a *duty* done; but, if they should have marched from the parade, it stands for a *duty* done, though they should be dismissed immediately.

General courts-martial that have assembled, and the members sworn in, shall be reckoned on *duty*, though they should be dismissed without trying any person.

E

* **ENCYCLOPÆDIA**, meant originally no more than a circle; but at present it comprehends the whole circle or compass of learning, which comprehends all liberal arts and sciences.

* **ENGAGEMENT**, in a *military sense*, implies a particular or general battle by land, or an action of hostility between detachments of infantry or cavalry. The combat usually begins by a vigorous cannonade, accompanied with the whole efforts of the small arms, and the attack of the horse, sword in hand.

The various exigencies of the combat call forth the skill and resources of the general, to keep the line of battle as complete as possible, when it has been equally attacked; by ordering

troops from the reserve, to supply the place of others who have suffered greatly by the action. His vigilance is ever necessary to review the situation of the enemy from van to rear, every motion of whom he should, if possible, anticipate and frustrate. He should seize the favourable moments of occasion, which are rapid in their progress, and never return. See **BATTLE**, in the first Alphabet.

EPAULETTES, as a *military ornament*, are worn by all officers of the royal regiment of artillery, infantry, and cavalry. Those for the dragoon-guards, horse and dragoons, to have a gold or silver embroidered or laced *epaulette*, with fringe on the left shoulder. Those of the light dragoons to have one on

each shoulder. The officers of grenadiers to wear an *epaulette* on each shoulder. Those of the battalion to wear one on the right shoulder only. They are to be either of embroidery or lace, with gold or silver fringe. Those of the royal regiment of artillery to be gold em-

broidery, with gold fringe on scarlet cloth, and worn on the right shoulder. The cloth of *epaulettes* for the private men to be of the colour of the facing, with a narrow yellow or white tape round it, and worsted fringe.

F

FACE, of a *bastion*, the two sides reaching from the flanks to the salient angle. These in a siege are commonly the first undermined, because they extend most outwards, and are the least flanked; consequently the weakest.

FACE prolonged, } is that part of the line of
FACE extended, } defence *razant*, which is terminated by the curtain and the angle of the shoulder; that is, it is strictly taken the line of defence *razant*, diminished by the face of the bastions.

FERDWIT, in *ancient military history*, a term formerly used to denote a freedom from serving upon any military expedition; or, according to some, the being quit of manslaughter committed in the army.

FIELD, or *field of battle*, denotes a place where a battle was fought.

FIELD-fort. See **FORT**.

FIELD-works. See **WORKS**.

Running-FIGHT, that in which the enemy is continually chased.

FIRE, in the *art of war*, is the discharge of all sorts of fire-arms against the enemy. The fire of the infantry is by a regular discharge of their firelocks, by platoons, divisions, &c. that of the cavalry, with their fuzes and pistols; and that of a place besieged, from their artillery.

FIRE of the curtain, or *second flank*, is from that part of the curtain comprehended between the face of the bastion prolonged, and the angle of the flank; frequently called the line of defence *sichant*.

FIRE razant, is by firing the artillery and small arms in a line parallel with the horizon, or parallel with those parts of the works you are defending.

FORTIFICATION. See this word in the first Alphabet.

Approaches, are a kind of roads or passages sunk in the ground by the besiegers, whereby

they approach the place under cover of the fire from the garrison.

Caponier, is a passage made in a dry ditch from one work to another: when they are made from the curtain of the body of the place to the opposite ravelin, or from the front of a horn or crown-work, they have a parapet on each side, of 7 feet high, sloping in a glacis on the outside to the bottom of the ditch: the width within is from 15 to 18 feet, with a banquette on each side: there is a brick wall to support the earth within, which only reaches within $1\frac{1}{2}$ foot of the top, to prevent grazing shot from driving the splinters amongst the defendants.

Caponiers with two parapets may properly be called double; as there are some made with one parapet only, in dry ditches of the ravelin, and in that of its redout, towards the salient angles, and open towards the body of the place.

Caponiers made from the body of the place to the out-works, are sometimes arched over, with loop-holes to fire into the ditch. The single ones in the ditch of the ravelin and redout are likewise made with arches open towards the place; for by making them in this manner, the guns which defend the ditch before them, can no other way be dismounted than by mines.

* *Affault*, is a sudden and violent attack, made uncovered, on the part of the rampart where the breach has been made.

* *Attack*, is the manner and disposition made by an army or smaller body of men, to drive an enemy out of a fortified place, or out of any strong situation, or to gain a post, &c.

Attacks of a siege. See **SIEGE**.

False attacks. See **SIEGE**.

To attack in flank, at a siege, is to attack both sides of the bastion; but against troops, is to fire along their line.

Barbet. See **BATTERY**.

* *Body of the place*, in a general sense, means the

the buildings in a fortified town : yet the inclosure round them is frequently understood by it ; for we say, to construct the body of the place, which means no more than to fortify or inclose the place with bastions and curtains, &c.

Breast-work. See PARAPET.

* *Capital of a work*, is an imaginary line which divides that work into two equal parts.

* *Capital of a bastion*, a line drawn from the angle of the polygon to the point of the bastion, or from the point of the bastion to the centre of the gorge. These capitals are from 35 to 40 toises in length, from the point of the bastion to the place where the two demi-gorges meet.

* *Centre*, the middle point of any work. From the centre of a place are drawn the first lines to lay down the form of a *fortification*.

* *Centre of the bastion*, is that point where the two adjacent curtains produced intersect each other.

Citadel, is a kind of fort or small fortification, of 4, 5, or 6 sides ; sometimes joined to towns, and sometimes to defend rivers or passes, &c. They are generally built on the most advantageous ground, when near a city, the better to command it, and commonly divided from it by an esplanade, or open place, the better to hinder the approach of an enemy.

Command, is when a hill or rising ground overlooks any of the works of a *fortification*, and is within reach of cannon shot ; such a hill is said to command that work. See COMMAND, in the first Alphabet.

* *Complement of the curtain*, is that part of the interior side which forms the demi-gorge.

* *Complement of the line of defence*, is the remainder of that line, after the angle of the flank is taken off.

* *Crowned horn-work*, is a *horn-work* with a *crown-work* before it. See CROWN-WORK, in the first Alphabet.

* *Demi-gorge*, is half the gorge or entrance into the bastion, not taken directly from angle to angle, where the bastion joins to the curtain, but from the angle of the flank to the centre of the bastion, or rather the angle the two curtains would make were they protracted to meet in the bastion.

* *Descent into the ditch*, is by trenches or guts made by way of saps in the ground of the countericarp, under the covert-way, and covered with inadrriers, or clays well loaded with earth, to secure them against fire. In ditches that are full of water, the descent is made even to the superficies of the water ; and then

the ditch is filled with faggots, fast bound, and covered with earth. In dry ditches the *descent* is carried down to the bottom ; after which traverses are made, either as lodgements for the troops, or to cover the miner.

Draw-bridge. See BRIDGE, in the first Alphabet.

Enfilade. A work is said to be enfiladed, when the artillery can fire into it, so that the shot can fly along the inside of the parapet.

* *Enveloppe*, is a work of earth raised sometimes in the ditch, sometimes like a plain parapet, and sometimes like a small rampart with a parapet to it. They are generally made before weak places.

Epaule, or the shoulder of the bastion, the angle made by the union of the face and flank.

* *Escarp*, is, properly speaking, any thing high and steep, and is used in *fortification* to express the outside of the rampart of any work next to the ditch.

* *Face prolonged*, that part of the line of defence razant, which is terminated by the curtain, and the angle of the shoulder.

Gorge of a flat bastion, is a right line, which terminates the distance between two flanks.

Gorge of a half-moon, the distance between the two flanks, taken on the right of the countericarp.

Gorge of a ravelin, is the distance between the two sides or faces towards the place.

Gorges of all other out-works, are the entry into them from the place, the distance between their sides.

Gallery, is a passage made under ground, leading to the mines : they are from 4½ to 5 feet high, and about 3½ or 4 feet broad ; supported at top by wooden frames, with boards over them.

* *Head of a work*, its front next the enemy, and farthest from the place.

Insult. A work is said to be *insulted*, when it is attacked suddenly and openly.

* *Interior side of a fortification*, an imaginary line drawn from the centre of one bastion to that of the next, or rather the curtain produced 'till they meet.

* *Place*, is commonly used in *fortification* instead of a fortified town.

Regular place, one whose angles, sides, bastions, and other parts are equal, &c.

Irregular place, one whose sides and angles are unequal, &c.

Salient angle, is that whose point turns from the centre of the place outwards.

* *Sconce*, a small field fort, built for the defence of some pass. See FORT.

F O R

Swallow's tail, a kind of out-work, only differing from a single tenaille, in that its sides are not parallel as those of the tenaille, but narrower towards the town than towards the country.

* *Terre plein of the rampart*, the horizontal superficies of the rampart, between the interior talus and the banquette. It is on the *terre plein* that the garrison pass and re-pass; it is also the passage of the rounds.

* *Wicket*, a small door in the gate of a fortified place, at which a man on foot may go in, and which may be opened though the gate is ordered to be kept shut.

Works. All the fortifications about a place are called the *works* of a place.

Out-works. All detached *works* in a *fortification* are so called.

Field FORTIFICATION, is the art of constructing all kinds of temporary works in the field, such as redouts, field-forts, star-forts, triangular and square forts, heads of bridges, and sundry forts of lines, &c. An army intrenched or fortified in the field produces, in many respects, the same effect as a fortress; for it covers a country, supplies the want of numbers, stops a superior enemy, or at least obliges him to engage at a disadvantage.

The knowledge of a field-engineer being founded on the principles of *fortification*, it must be allowed, that the art of fortifying is as necessary to an army in the field, as in fortified places; and though the maxims are nearly the same in both, yet the manner of applying and executing them with judgement, is very different.

A project of *fortification* is commonly the result of a long meditation; but in the field it is quite otherwise: no regard is to be had to the solidity of the works; every thing must be determined on the spot; the works are to be traced out directly, and regulated by the time and number of workmen, depending on no other materials than what are at hand, or no other tools than the spade, shovel, pick-axe, and hatchet. It is therefore in the field, more than any where else, that an engineer should be ready, and know how to seize all advantages at first sight, to be fertile in expedients, inexhaustible in inventions, and indefatigably active.

Names of all the works used in field FORTIFICATION.

Bridge-heads, in *field fortification*, are made of various figures and sizes, sometimes like a

redan or ravelin, with or without flanks, sometimes like a horn or crown-work, according to the situation of the ground, or to the importance of its defence. Their construction depends on various circumstances; for, should the river be so narrow, that the work may be flanked from the other side, a single redan is sufficient; but when the river is so broad, that the salient angle cannot be well defended cross the river, flanks must be added to the redan; but should a river be 100 toises or more across, half a square may be made, whose diagonal is the river side; and where a river is from 3 to 500 toises broad, a horn or crown-work should be made. All the different sorts of *heads of bridges*, are to be esteemed as good works against a sudden onset only, and their use almost momentary, as they sometimes serve but for a few days only, and at most during a campaign.

Forts, in *field-fortification*, are of various sorts, viz.

Field-forts, may be divided into two kinds; the one defending itself on all sides, as being entirely surrounded; the other, bordering on a river, &c. remain open at the gorge. They have the advantage of redouts, in being flanked, and the disadvantage in containing less within, in proportion to their extent.

Star-forts, are so called, because they resemble that figure. They are commonly made of 4 angles, sometimes of 5, and very rarely of 6; but we find them now made of 7 and 8 angles: but, let their figure be what they will, their angles should be equal; and, can they be formed of equilateral triangles, so much the better; for then the flanking angle being 120° , the fires cross better and nearer; and as the 2 flanks are on the same line, the space, not defended before the salient angle, is reduced to a parallelogram, whose smallest side is equal to the gorge.

Bastioned forts, differ in nothing from that of places, except that the figure be less, and the attack supposed of another kind. It is reckoned sufficient to flank them with half-bastions.

Triangular forts. As these kinds of *forts* contain less in proportion than any other, they are consequently to be used as seldom as possible.

Square forts, are in many respects preferable to the triangular ones. See FORT, in the first Alphabet.

Dams, are generally made of earth, but sometimes of other materials, as occasion may require: their use is to confine water.

Flèche,

Flèche, a work consisting in two faces, terminating in a salient angle of 90° . the faces are generally 75 or 80 feet long, the parapet 6 feet thick, and the ditch 7 feet broad.

Lines, in field fortification, are of several sorts, viz. the front of a fortification, or any other field-work, with regard to the defence, is a collection of lines, contrived so as reciprocally to flank each other.

Lines of intrenchment, are made to cover an army, or a place indifferently fortified, and which sometimes contains the principal magazine of an army; or to cover a considerable extent of ground, to prevent an enemy from entering into the country to raise contributions, &c.

Lines, let their form or shape be what they will, should be every where equally strong, and every where guarded alike.

Maxims. 1st. To inclose with the work as much ground as possible, having regard to circumstances. This attention chiefly concerns redouts and small works.

2d. If there are several works near each other, their lines of defence should be so directed, as to defend each other, without annoying themselves by their own fire.

3d. Not to depend on the defence of small arms, but where they can fire at right angles; as they generally fire without aim, and directly before them.

4th. Not to have recourse to the 2d flank or fire of the curtain, but when there is an absolute necessity.

5th. That the flanking angle be always a right one, or more obtuse, but never to exceed 100° , if possible, as there is no fear here, as in a fortification, of the flank being too much exposed. Besides, it is not necessary to graze the faces, or even to fire obliquely on them; since there is no danger of being exposed to the defence of a breach, or lodgement of the miners. The only thing to apprehend, is a sudden attack.

6th. That the flanking parts be sufficiently extended, so that the interior of their parapets at least rake the whole breadth of the opposite ditch.

7th. Never to make an advanced ditch in dry ground, unless it can be enfiladed through-out, and under a proper angle to be defended by the work which it covers or surrounds.

8th. Not to allow more than from 60 to 80 toises for the lines of defence, when they proceed from two flanks separated by two branches, forming a salient angle, or when not made to cross, though produced.

9th. That the parts most extended, and consequently the weakest in themselves, be as much defended as possible, and have at least the fire of two flanks, besides their own direct fire.

Redans, are a sort of indented works, consisting of lines or faces, that form salient and re-entering angles, flanking one another. Lines are often constructed with redans: their salient angles are generally from 50 to 70° .

Indented redans, are when the two faces are indented (see Pl. XV. fig. 2.) in that case the faces of each indented angle is $8\frac{1}{2}$ feet only.

Tambour, a kind of work formed of pallisades, 10 feet long, and 6 inches thick, planted close together, and driven 2 or 3 feet into the ground; so that when finished it has the appearance of a square redout cut in two. Loop-holes are made 6 feet from the ground, and 3 feet asunder, for the soldiers to fire through, who are placed on scaffolds 2 feet high. They have often been used by the French with great advantage.

Têtes-de-pont. See *Bridge-heads*.

Trous-de-loup, are holes dug in the ground, circular at top, about $4\frac{1}{2}$ feet diameter, and 6 feet deep, pointed at bottom, like an inverted cone, or sugar-loaf. A stake 6 feet long is fixed in their centre, driven 2 feet into the ground, and made sharp at top. Two or three rows of them are dug chequer-wise, about 6 paces from the ditch of a field-work. They prevent the approach of horse, &c.

* *FLOOR*, a measure formerly used by our engineers, and in some parts of England at present. Its dimensions are as follow: a measuring rod of 9 feet, two of which are called a perch or pole; that number squared; that is, 18 feet each way at right angles, and 1 foot deep, i. e. 324 solid feet of earth is called a *floor*.

* *FRONTLET*, or *aim frontlet*, is a piece of plank 3 inches thick, 1 foot long, and 7 or 8 inches high, with a round cavity underneath, to fit the outside of the gun, with a slit to see the object through it. It is placed on the vent-field, to direct the gunners in pointing.

G A U

G U N

GAUGES, in *gunnery*, are brass rings, with handles, to find the diameter of all kinds of shot with expedition.

GORGE. See FORTIFICATION.

GRAVITY, in *mechanics*, the natural tendency which all bodies have towards a centre.

Absolute GRAVITY, is the whole force with which a body tends downwards, or towards the centre of the earth, and is always equal to the quantity of matter the body contains, without any regard to its bulk, so that the *absolute gravity* of a pound of wood is equal to that of a pound of iron.

Relative GRAVITY, } is the excess of gravity

Specific GRAVITY, } of one body above that of another of equal dimensions, and is always proportionable to the quantity of matter under that dimension. Thus a cubic inch of lead is heavier than a cubic inch of wood; for the lead, being more dense than the wood, contains a greater quantity of matter under the same bulk. See GUNNERY.

*To give GROUND, in a *military sense*, is to retire, to abandon or lose the post a body of men has been in.

GUNNERY, is that military art which teaches us to determine the course and to direct the motion of bodies shot from artillery, or other warlike engines. The great importance of this art, is the reason that we distinguish it from the doctrine of projectiles in general; for in truth it is no more than an application of those laws which all bodies observe when cast into the air, to such as are put in motion by the explosion of guns, or other engines of that sort: and it differs not whether we talk of projectiles in general, or of such only as belong to *gunnery*; for, from the moment the force is impressed, all distinction, with regard to the power which put the body first in motion, is lost, and it can only be considered as a simple projectile.

Every body cast into the air, moves under the influence of two distinct forces. By the one it is carried forward with an equal motion, and describes equal spaces in equal times, in the direction in which it was projected; and by the other, which we call *gravity*, is drawn downwards in lines perpendicular to the surface of the earth, with a motion continually accelerated, or whose velocity is always increasing. If either of these forces were destroyed, the body would move according to the direction of

the other alone, so far as its motion was not hindered by the interposition of other bodies; but as both continue to act, the course of the projectile must be determined by a power compounded of those two forces.

Definitions of GUNNERY.

1. The *impetus* at any point of the curve is the perpendicular height to which a projectile could ascend, by the force it has at that point; or the perpendicular height from which a body must fall to acquire the velocity it has at that point.

2. The *diameter* to any point of the curve is a line drawn through that point perpendicularly to the horizon. Thus AX , ax , are *diameters* to the point A , a , Pl. XVI. fig. 10.

3. The points A , a , where the diameters cut the curve, are called *vertexes* to these diameters.

4. The *axis* is that diameter which cuts the curve in its highest or principal vertex, and is perpendicular to the tangent at that point or vertex. Thus ax is the *axis* of the curve AC , and is perpendicular to the tangent at .

5. The *ordinates* to any diameter are lines drawn parallel to the tangent at the point where that diameter cuts the curve, and intercepted between the diameter and curve. Thus Da is an *ordinate* to the diameter AX , and dC is an *ordinate* to the axis ax , which is always at right angles with it.

6. The *absciss* is that part of the diameter which is intercepted between the ordinate and the curve. Thus AD is an *absciss* of the diameter AX , and ad one of the diameter ax .

7. The *altitude* of the curve is the perpendicular height of the principal vertex above the horizon. Thus ad is the *altitude* of the curve AaC .

8. The *amplitude*, *random*, or *range*, is the distance between the point of projection and the object aimed at. Thus AC is the *amplitude*, &c. of the curve AaC .

9. The *elevation* of the piece, is the angle its axis (produced) makes with the horizon, and the axis itself is called the direction.

10. The *horizontal distance*, to which a mortar, elevated to a given angle, and loaded with a given quantity of powder, throws a shell of a given weight, is called the range of that mortar, with that charge and elevation.

11. The *inclination of a plane*, is the angle it makes with the horizon, either above or below.

12. The

12. The *directrix* is a line passing through *M*, perpendicular to *AM*.

Laws of motion in GUNNERY.

1. Spaces equally run through with equal velocities, are to one another as the times in which they are run through, and conversely.

2. Spaces equally run through in the same or equal times, are to one another, as the velocities with which they are run through, and conversely.

3. Spaces run through are in the same proportion to one another, as their times multiplied into their velocities, and conversely.

4. A body urged by two distinct forces in two different directions, will in any given time be found at the point where two lines meet that are drawn parallel to these directions, and though the points to which the body could have moved in the same time, had these forces acted separately.

5. The velocities of bodies, which by the action of gravity began to fall from rest, are in the same proportion as the times from the beginning of their falling.

6. The spaces run through by the descent of a body which began to fall from rest, are as the squares of the times, from the beginning of the fall.

7. The motion of a military projectile is in a curve.

Remarks on GUNNERY. As some who are entrusted with the management of artillery, are but too frequently found ignorant of the mathematical elements on which it is built, we shall endeavour to supply that defect in some measure by exhibiting two tables of proportions, which flow from the before-mentioned properties, which those who peruse the preceding laws of motion will perceive to flow from the pro-

perties there demonstrated; and those who do not, will be kind enough to take for granted.

The young artillerist will, I hope, by the help of these few proportions, be rendered more capable of performing what is usually required in *gunnery*, than he could by mere practice.

In order to hit any mark, find your distance from it; (the piece's impetus you are supposed to know) and then use this proportion.

Twice the impetus is to the amplitude, as radius is to the sine of double the angle of elevation. This angle is found practically by a quadrant and plummet, but best by a spirit-level and quadrant fixed on a ruler: but when the object is so near, that you can take aim with your eye, you need only dispart your piece.

The piece is supposed to be truly bored, its carriage-wheels of an equal height, the ground whereon these stand level, the trunnions equally high on the carriage, the gun placed exactly in the middle of the carriage, and at right angles with the axle-tree.

The gunner is also supposed to know the use of such instruments as are necessary for his purpose in the field; to have made frequent and exact trials of the gun's impetus, with a certain charge of the same powder; to have nicely proportioned that charge to the weight of the shot, and the execution he intends with it, at a given distance; and to have made such other observations as in the course of his practice he will find useful. These things being supposed, the two following tables will at one view give all the necessary cases for firing at objects on the plane of the horizon, with proportions for their solutions; as also those for firing on ascents and descents; and none I think can be proposed, that depend not immediately on, or may not be easily solved from them, in common practice.

G U N

TABLE I. For Horizontal Projections. Fig. 8 and 9. Pl. XVI.

Cases	Given	Required	Solutions.
1	AM, Am	$t AH$ Hv	$2 AM : Am :: R : S_2 \angle t AH.$ $R : T \angle t a H :: \frac{Am}{4} : Hv.$
2	$AM, t AH$	Am	$R : S_2 \angle t a H :: 2 AM : Am.$
3	$Am, t AH$	AM	$S_2 \angle t AH : R :: \frac{Am}{4} : AM.$
4	AM, Hv	Am	$\sqrt{AN \times NM} = \frac{AM}{4}$, or $\frac{1}{2} \log. AN + \frac{1}{2} \log. NM + \frac{1}{2} \log. NM = \log. \frac{1}{2} Am.$
5	Am, Hv	$t AH$ AM	$\frac{AM}{4} : Hv :: R : T \angle t a H. AN : \frac{Am}{4} :: \frac{Am}{4} : NM,$ and $AN + NM = AM.$
6	$Hv, t AH$	Am	$T \angle t AH : R :: Hv : \frac{Am}{4}.$
7	$t AH, Am$ and any other angle. Any other amplitude.	Any other amplitude belonging to that angle. Any other angle belonging to that amplit.	$S_2 \angle t AH : S_2$ any other $\angle :: Am : \text{amplitude required.}$ $Am : \text{any other amplitude} :: S_2 \angle t a H : S_2 \angle \text{required.}$
8	$t AH, Hv$ any other angle. Any other altitude.	Any other altitude. Any other angle.	$V. S_2 \angle t AH : V. S_2$ any other $\angle :: Hv$ altitude required. $Hv : \text{any other altitude} :: V. S_2 \angle t AH V. S_2 \angle \text{required.}$

The same stated numerically.

Case 1. The impetus $AM = 4000$, and amplitude $AM = 4200$ given, the direction $t AH$, and altitude $v H$ required.

$8000 : 4200 :: R. S. 2 \angle \left\{ \begin{smallmatrix} 15^\circ 50' \\ 74 \quad 10 \end{smallmatrix} \right\}$ the $\left\{ \begin{smallmatrix} \text{lowest} \\ \text{highest} \end{smallmatrix} \right\}$ direction.

Or to the log. of 4200 add radius, and from their sum subtract the log. of 8000, the remainder will be the logarithmic sine of $\left\{ \begin{smallmatrix} 31^\circ 40' \\ 148 \quad 20 \end{smallmatrix} \right\}$

half of which is $\left\{ \begin{smallmatrix} 15^\circ 50' \\ 74 \quad 10 \end{smallmatrix} \right\}$ for the $\left\{ \begin{smallmatrix} \text{lowest} \\ \text{highest} \end{smallmatrix} \right\}$ direction.

$R : \text{tangent} \angle 15^\circ 50' :: 1050 : 298$ the altitude.

Or to the logarithmic tangent of $15^\circ 50'$ add the log. of 1050, and from their sum subtract radius, the remainder will be the log. of 298, the altitude required.

Case 2. The impetus $AM = 3600$, and the direction $t AH = 75^\circ$ given, to find the amplitude AM .

$R. S_2 \angle 75^\circ :: 7200 : 3600$ amplitude AM .

Case 3. The amplitude $AM = 3000$, and direction $G AH = 45^\circ$ given, to find the impetus AM .

Sine $2 \angle 45^\circ : R :: 1500 : 1500$ impetus AM .

Case 4.

Case 4. The impetus $AM = 2600$, and altitude $Hv = 1300$ given, to find the amplitude.

$AM - AN = NM = 1300$, and $\sqrt{AN \times NM} = 1300$, a fourth part of 5200 the amplitude.

Case 5. The amplitude $AM = 3140$, and altitude $Hv (AN) = 250$ given, to find the direction and impetus.

$785 : 250 :: R : \text{tangent of } \begin{Bmatrix} 17^\circ & 40' \\ 72 & 20 \end{Bmatrix}$ the
 $\begin{Bmatrix} \text{lower} \\ \text{higher} \end{Bmatrix}$ direction. $250 : 785 :: 785 : 2465$, which, added to 250, give the impetus 2715.

Case 6. The altitude $Hv = 368$, and direction $tAH = 40^\circ 15'$ given, to find the amplitude.

Tang. $\angle 40^\circ 15' : R :: 368 : 435$, the 4th part of 1740 the amplitude.

Case 7. The direction $tAH = 28^\circ 12'$ with its amplitude $AM = 2550$, and any other direction $= 37^\circ 28'$ given, to find the amplitude for that direction.

Sine $\angle 56^\circ 24' : 2550 :: S \angle 74^\circ 56' : 2956$, the amplitude sought.

Case 8. The altitude $Hv = 180$, with its direction $tAH = 24^\circ 5'$ and any other altitude $= 400$ given, to find the direction for that other altitude.

$180 : 400 :: \text{versed sine } 48^\circ 10' : \text{versed sine } 74^\circ 56'$, half of which is $37^\circ 28'$, the direction sought.

TABLE II. For Projectiles on Ascents and Descents. Fig. 6 and 7. Pl. XVI.

Cases	Given	Required	Solutions.
1	AM, Am Bm, AB	$tAH,$ tAH	$Am : Bm :: R : T. \angle BAm$, $\frac{1}{2}$ of which added to 45° gives $\angle GAz$. $AM : AB :: Ac : AC = CG. T. \angle GAz : R :: Gz : Az$ and $Az - Af = fz = PG$. $CG : PG :: R : V. S. \text{ of } SG$, $\frac{1}{2}$ of which added to, or taken from, GAz , gives the higher or lower direction required.
2	tAH, tAH $AF.$	AM	Log. of $AM = \text{log. of } AF + 2 \text{ log. } S. \angle MAF - \text{log. } S \angle AF - \text{log. } S \angle MAs$.
3	tAH, tAH AM	AF	Log. of $AF = \text{log. of } AM + \text{log. } S \angle MAF + \text{log. } S \angle MAs - 2 \text{ log. } S \angle MAF$.
4	BAm $tAH, AB,$ & any other angle tAH .	ab , the amplitude for that other angle.	Log. of $Af = \text{log. of } AF + \text{log. } S \angle pAf + \text{log. } S \angle pAM - \text{log. } S \angle sAF - \text{log. } S \angle MAs$. Fig. 9.
5	$AM,$ DAH	$Ag.$	$T \angle GAz : \text{sec. } \angle gAz :: Gz : Ag$. Fig. 6 and 7.

The same stated numerically.

Case 1. The horizontal distance $Am = 7000$, impetus $AM = 4200$, and the perpendicular height $Bm = 744$ given, to find the directions tAH, tAH .

$7000 : 744 :: R : \text{tangent } 6^\circ 4'$, half of which added to 45° gives the angle $GAz = 48^\circ 2'$.

$7000 : 7040 :: 2100 : 2112$. Tangent $48^\circ 2' : R :: 2100 : 1887.5$. $2112 : 137.5 :: R : \text{versed sine of } 20^\circ 48'$, half of which added to, or subtracted from, $48^\circ 2'$, gives $\begin{Bmatrix} 58^\circ & 26' \\ 37 & 38 \end{Bmatrix} =$

$\begin{Bmatrix} tAH \\ tAH \end{Bmatrix}$ the $\begin{Bmatrix} \text{higher} \\ \text{lower} \end{Bmatrix}$ direction.

Case 2. The angles of direction $\begin{Bmatrix} tAH = \\ tAH = \end{Bmatrix}$

G U N

$58^{\circ} 26'$
 $37 \quad 38$ } and the amplitude $AB = 7040$ given,
to find the impetus AM .

To the log. of $AF = 1760$ add twice the logarithmic sine of the angle $MAF = 83^{\circ} 56'$, and from their sum subtract the logarithmic sines of the angles $SAF = 31^{\circ} 34'$, and $MAs = 52^{\circ} 22'$, the remainder will give the log. of $2004 = AM$, the impetus required.

Case 3. The angles of the direction $\begin{Bmatrix} T AH \\ t AH, \end{Bmatrix} = \begin{Bmatrix} 58^{\circ} 26' \\ 37 \quad 38 \end{Bmatrix}$ and impetus $AM = 4200$ given, to find the length of the inclined plane AB , or the horizontal distance Am , and perpendicular height Bm .

To the log. of $AM = 4200$, add the logarithmic sines of the angles $SAF + 31^{\circ} 34'$, and $MAs = 52^{\circ} 22'$, and from their sum subtract twice the logarithmic sine of the angle $MAF = 83^{\circ} 56'$, the remainder will give the log. of $1760 = AF$, a fourth part of $7040 = AB$, the inclined plane.

Case 4. The angle of obliquity $BAm = 6^{\circ} 4'$, any angle of direction $tAH = 37^{\circ} 38'$ and its amplitude $AB = 7040$, and any other angle of direction $tAH = 31^{\circ} 4'$ given, to find the amplitude Ab for that other angle.

To the log. of $AF = 1760$ add the logarithmic sines of the angles $pAf = 25^{\circ}$, and $pAM = 58^{\circ} 56'$, and from their sum subtract the logarithmic sines of the angles $SAF = 31^{\circ} 34'$, and $MAs = 52^{\circ} 22'$, the remainder will give the log. of $1537 = Af \frac{1}{4}$ part of $6148 = Ab$ the amplitude. The converse of this case is evident.

Case 5. The impetus $AM = 4200$, and angle of obliquity $DAH = 6^{\circ} 4'$ given, to find the greatest random on the plane AB .

Tangent $\angle 48^{\circ} 2' : \sec. \angle 6^{\circ} 4' :: 2100 : 1899$, a fourth part of 7596 the greatest range.

SCHOLIUM.

When the perpendicular height is given, and the horizontal distance is required, the readiest and, we think, the best way of finding it, is to observe, with an instrument, the angle which the object aimed at makes with the horizon, and to use this proportion.

As the tangent of that angle is to the perpendicular height given,

So is the radius to the horizontal distance required.

But when the horizontal distance is given, and the perpendicular height is required, say,

As radius is to the horizontal distance given,

So is the tangent of the angle found by observation, to the perpendicular height of the object required.

Example. Supposing in the first case Bm given $= 744$, and the angle BAm taken $6^{\circ} 4'$ say, tangent $\angle 6^{\circ} 4' : 744 :: R : 7000$, the horizontal distance.

And in the second case, supposing Am given $= 7000$, and the angle BAm taken $= 6^{\circ} 4'$, then say,

$R : 7000 :: \text{tang.} = 6^{\circ} 4' : 744$, the perpendicular height.

Thus all the cases of projections, as well on horizontal as on inclined planes, can be applied to numbers; and any mixed questions which contain cases both on horizontal and inclined planes, may be deduced from them almost by inspection. For instance:

1. Suppose a piece of artillery planted at A (fig. 6) its angle of direction $tAH = 37^{\circ} 38'$, the horizontal distance of the object $Am = 7000$, and its perpendicular height $Bm = 744$ given; to find that piece's amplitude on a horizontal plane, with the same impetus at any given direction; or its direction on a horizontal plane with any other given amplitude.

By *case 2*, of ascents and descents, find its impetus $= 4200$; then by *case 2*, of horizontals, find its amplitude $= 7274$, with the other given direction of 30° for example; or by *case 1*, of horizontals, find its direction equal to 30° , with the other given amplitude 7274 .

2. The random and direction of a piece on the plane of the horizon being given, to find its random on an inclined plane of a given obliquity, and with a given direction.

First, find its impetus by *case 2*, of horizontals, and then its amplitude by *case 3*, of ascents and descents.

3. Having the greatest range of a piece on a plane of a given inclination, to find its greatest amplitude on the horizon, say,

As the secant of the angle FAf is to the tangent of the angle GAz ,

So is the fourth part of the greatest range on the inclined plane, to a fourth part of the greatest range on the horizon.

H

H A R

K I T

* **HARBOURS**, in *military architecture*, a port or haven for shipping. The making and inclosing *harbours* with piers, so as to resist the winds and waves, for the preservation of ships in stormy weather, is one of the most useful and necessary works that can be made in a trading nation; since the security of their wealth and power depends greatly upon it. Hence it should be the particular study of every young engineer, who is desirous of being useful to his country, or of distinguishing himself, to make himself master of this branch of business: to which end, let me recommend *L'Architecture Hydraulique*, par M. Belidor; *Essai sur la Résistance des Fluides*, par M. d'Alembert, Maclaurin and Muller.

* **HARQUEBÜS**, in *military history*, a kind of fire-arms, of the length of a musket, usually cocked with a wheel. It carries a shot of about 3 ounces. Not used at present.

HONOURS of war, in a *siege*, is when a governor has made a long and vigorous defence; is at last obliged to surrender the place to the enemy, for want of men and provisions; and makes it one of his principal articles, to march out with the *honours of war*; that is, with shouldered arms, drums beating, colours flying, and all their baggage, &c.

HOSTAGE, in the *art of war*, a person given up to an enemy, as a security for the performance of the articles of a treaty. When two enemies enter into a treaty or capitulation, it is common for them mutually to give hostages, as a security for their reciprocally performing the engagement they have entered into. An hostage becomes either an accessory, or principal, according to the state of things. Thus, for example, he is accessory, when a prince promises fidelity to another prince, and gives either his son, or some great lord, as a security for his performance, without any further capitulation; for then these *hostages* are only an

additional engagement of the prince; and if he violates his word, they are not in any manner responsible. An *hostage* becomes a principal, when it is stipulated that he shall be answerable for the event of things. For instance, if a city promise to surrender within a certain time, in case it is not succoured, and, for the security of this article, give *hostages*; (which are in the same nature as bail given to a creditor to secure a debt:) so that, if the succour arrives in time, the promise becomes void, and the *hostages* are discharged; but if the succours do not arrive, and the city is guilty of a breach of faith, by refusing to surrender, then the *hostages* become principal, and may be punished for a breach of faith.

HOWITZER. See this word in the first Alphabet.

Dimensions of brass HOWITZERS, as established by the Board of Ordnance in 1764.

Nature	Length		Weight		Calibre of the howitz.	Diam. of the shell	Cham. con. pdr.
	Inche	ft. In.	C.	q.	lb.	In. hun.	lb. oz
8	3	1	11	0	0	8.0	7.75 3 8
5.8	2	2	4	0	14	5.62	5.50 1 0
4.5	1	10	2	0	14	4.42	4.40 0 8

N. B. The length is taken from the face of the muzzle to the back of the base ring, exclusive of the length of the cascable.

HOWITZ-battery, is made the same as a gun-battery, only the embrasures are made at least a foot wider, on account of the shortness of the *howitz*. See **BATTERY**.

K

* **KIT**, in *laboratory works*, a composition made of rosin 9lb. pitch 6lb. bees-wax 6lb. and tallow 1lb. used for the last covering of carcases. When used, it must be broke into small pieces, and put into an iron pot,

over the fire, and kept stirring about until it is all dissolved, and made very hot, which it must be whenever used; for it is then much better, and lies more equal, and closer on the carcass, than when it grows cold.

KITCHEN,

K I T

KITCHEN, in the *art of encamping*, is a space of about 16 or 18 feet diameter; with a ditch surrounding it, 3 feet wide, the opposite bank of which serves as a seat for the men who dress the victuals. The *kitchens* of the flank companies are contiguous to the out-line

of the camp, and the intermediate space is generally distributed equally for the remaining *kitchens*; and as each tent forms a mess, each *kitchen* must have as many fire-places as there are tents in the company.

L

LABORATORY. See that word in the first Alphabet.

Cartridges, are generally made of flannel, and filled with the following quantities of corned powder, both for land and sea service, viz.

Heavy	42-pound.	14lb.	Medium	18-pdrs.	6½ lb.
	32 ———	10½		12 ———	4½
	24 ———	8		6 ———	2½
	18 ———	6½		3 ———	1½
	12 ———	5	Light	24 ———	5
	6 ———	3		12 ———	3
	3 ———	1½		6 ———	1½
				3 ———	12 oz.

These *cartridges* are frequently fixed to round-

shot, to case-shot, and to grape-shot, for the greater expedition in firing. See *Cartridges*, at the word **LABORATORY**, in the first Alphabet.

Flambeaux, a kind of lighted torch, used in the artillery upon a march, or the park, &c.

Formers, are cylinders of wood, of different sizes and dimensions, used in the *laboratory*, to drive the composition of fuzes and rockets.

Funnels, are of various sorts, used to pour the powder into shells, and the composition into fuzes, and rocket-cases.

Fuzes. See *Fuzes*, at the word **LABORATORY**, in the first Alphabet.

TABLE of the different dimensions of Fuzes, and time of burning, &c.

Natures	Length of fuze	Diameter under the cap	Diameter at the end	Diameter of the cap inside	Diameter of the cap outside	Length of composition	Time of burning	Diameter of composition	Depth of the cap
Inches	In. & 10.	In. & 10.	In. & 10.	In. & 10.	In. & 10.	In. & 10.	Seconds	In. & 10.	In. & 10.
13	10.5	2.1	1.6	1.5	2.2	9.6	35 to 3	0.6	1.1
10	8.9	1.7	1.3	1.3	1.9	8.1½	30 to 35	0.4	0.9
8	8.1	1.5	1.1	1.1½	1.7½	7.2	29 to 31	0.3½	0.8
5½	5.6	1.2½	0.9	0.9	1.3	4.6	18 to 21	0.3	0.6
4½	4.7	1.1	0.7½	0.8½	1.1	4.0	15 to 17	0.3	0.5½
Hand-fuze	3.2	0.9	0.6½	0.6½	0.9	2.7	12 to 14	0.2	0.4
Muf. mort.	3.1	0.7½	0.4½	0.5	0.7½	2.4½	10 to 12	0.1½	0.3½

How to drive Fuzes into the shells. When *fuzes* are to be drove, the lower end is cut off in a slope at the mark; so that the composition may give fire to the powder in the shell; and are to be of such a length, that the shell may burst as soon as it comes to the ground. The *fuze* is first put into the shell by the hand, and then

drove with a mallet as far as it will go; taking care, however, not to split it. As *fuzes* burn equal lengths, in equal times, great care must be taken, that those of each nature be drove with the same mixture of composition, equally hard, in the same kind of weather, and, if possible, by the same person.

TABLE

TABLE of shells' ranges, in yards, at 45° elevation, by which Fuzes may be cut to any range required

Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.
5	134	9½	459	13½	977	17½	1689	22	2595	26½	3694
5½	148	9½	484	13½	1017	18	1737	22½	2654	26½	3765
5½	162	9½	509	14	1050	18½	1785	22½	1714	26½	3856
5½	177	10	536	14½	1088	18½	1835	22½	275	27	3908
6	193	10½	563	14½	1127	18½	1885	23	2836	27½	3980
6½	209	10½	591	14½	1166	19	1935	23½	2896	27½	4054
6½	226	10½	619	15	1206	19½	1986	23½	2961	27½	4128
6½	244	11	649	15½	1246	19½	2038	23½	3024	28	4203
7	263	11½	678	15½	1288	19	2091	24	3088	28½	4278
7½	282	11½	709	16	1329	20	2144	24½	3153	28½	4354
7½	301	11½	739	16	1372	20½	2198	24½	3218	28½	4431
7½	322	12	772	16½	1416	20½	2252	24½	3284	29	4509
8	343	12½	804	16½	1459	21	2308	25	3350	29½	4587
8½	365	12½	834	16½	1504	21	2364	25½	3418	29½	4665
8½	387	12½	871	17	1549	21½	2420	25½	3486	29½	4745
8½	412	13	906	17½	1595	21½	2478	25½	3555	30	4825
9	434	13½	941	17½	1642	21½	2536	26	3624	30½	4905

By this table, if you know the distance, you likewise know how many seconds the shell was in the air; and by knowing the time, you also know the distance; and may cut the fuze accordingly, by burning one or two, and making use of a stop-watch with a second hand, or a pendulum that vibrates seconds. *Example.* Any number of seconds being given, required the range at an angle of 45° belonging to that time. *Rule.* Square the time of flight, and multiply that by $16\frac{1}{12}$, and the product divided by 3, the quotient gives the range in yards.

Example 1. How many yards in 12 seconds will the range be at 45 degrees elevation? viz.

$$\frac{12 \times 12 \times 16\frac{1}{12}}{3} = 772 \text{ yards; or } 12 \times 12 \times 193 = \frac{27792}{36} = 772 \text{ yards as before}$$

Example 2. The range of 45° being given, to know the seconds it was performed in, viz.

Rule. Multiply the range by 3, and divide the product by $16\frac{1}{12}$, the square root of the quotient gives the number of seconds; or, to avoid fractions, multiply the range by 36 the 12ths contained in 3, and divide the product by 193, the 12ths contained in $16\frac{1}{12}$, the square root of the quotient gives the seconds.

$$\sqrt{\frac{772 \times 3}{16\frac{1}{12}}} = \sqrt{\frac{2216}{16\frac{1}{12}}} = \sqrt{144} = 12 \text{ seconds;}$$

$$\text{or } 772 \times 3 \div 193 = \sqrt{2316 \div 193} = \sqrt{12} = 12 \text{ seconds, as before.}$$

Hair-cloths, are used on the floor of powder magazines, and other places in the laboratory, where powder is used, to prevent accidents by fire, from men's shoes treading or rubbing any thing that may strike fire.

Small ladders, are made of copper, with short handles: they are used in filling the fuzes of shells, and cases of sky-rockets, &c.

Port-fires, are paper cills of 17 inches long, and about $\frac{1}{2}$ an inch in diameter; one of which will burn from 13 to 16 minutes. They are used in firing guns, mortars, and howitzers; or to light recreative fire-works. Their composition is salt-petre 6 lb. sulphur 2 lb. and mealed powder 1 lb. mixed in the same manner as fuze composition. See *fuzes* and *port-fires*, at the word LABORATORY, in the first Alphabet.

Rockets, are of various sorts, and for various purposes; but those we shall here mention, are generally made use of for signals in the field.

Signal Rockets, They are sometimes made with reports, and sometimes without. They are sometimes made to be bounced; in this instance, their cases must be made $1\frac{1}{4}$ or 2 diameters longer than the common proportion. *Signal-rockets* with reports are sometimes fired in small flights, or otherwise, to begin an attack, &c. Their composition is, salt-petre, 4 lb. sulphur 1 lb. and charcoal 1 lb. 8 oz.

Setters, are round sticks to drive fuzes, or any other composition made of paper.

Sheep-skins, are always used to cover the muzzles

L A B

zles of mortars and howitzers, between firing, to prevent any wet or dampness from getting into them.

Shot, are of various denominations, and for sundry uses in the *art of war*.

Round-shot, are all kinds of *shot*, from a 42-pounder to an $\frac{1}{2}$ pounder.

Case-shot, are small *shot* put into cylindrical tin boxes, that just fit the bores of those pieces of artillery they are intended to be fired out of.

Their weight is from 6 oz. to 14 oz. and from 17 to 107 in one box. See *Case-shot*, at the word **LABORATORY**, in the first Alphabet.

Grape-shot, a certain number of small *shot* of iron or lead, quilted together with canvass and ropes about a pin of iron or wood, fixed upon a bottom of the same matter, so as the whole together weigh nearly as much as the *shot* of that calibre.

Length and weight of line for quilting sea-service Grape-shot.

Pounders.	Line		Wt. for 100	
	Feet	Inch.	lb.	oz.
42	10	1 $\frac{1}{2}$	14	8
32	9	2 $\frac{1}{4}$	12	0
24	8	10	10	10
18	7	4 $\frac{1}{2}$	5	12
12	6	4 $\frac{1}{2}$	4	14
9	6	0	3	10
6	5	1	2	10
4	4	7 $\frac{1}{4}$	1	3
3	4		0	12
$\frac{1}{2}$	2	3 $\frac{1}{2}$	0	4

See *Grape-shot*, at the word **LABORATORY**, in the first Alphabet.

Squibs. Their composition is, mealed powder 3 lb. charcoal 8 oz. salt-petre 3 oz. and sulphur 1 oz.

Tarpaulins, are made of strong canvas, thoroughly tarred, and cut into different sizes, according to their different uses in the field; such as to cover the powder-waggons, tumbrels, and field-pieces, from rain.

M

MAIL, or *coat of mail*, in *military antiquity*, a piece of defensive armour for the body, generally made of small iron rings, interwoven in the manner of a net.

MENSURATION, in *military mathematics*, is the art and science which is concerned about the measure of extension, or the magnitude of

figures; and it is, next to arithmetic, a subject of the greatest use and importance, both in affairs that are absolutely necessary in human life, and in every branch of the mathematics: a subject by which sciences are established, and commerce is conducted; by whose aid we manage our business, and inform ourselves of the

the wonderful operations in nature; by which we measure the heavens and the earth, estimate the capacities of all vessels and bulks of all bodies, gauge our liquors, build edifices, measure our lands and the works of artificers, buy and sell an infinite variety of things necessary in life, and are supplied with the means of making the calculations which are necessary for the construction of almost all machines.

It is evident that the close connection of this subject with the affairs of men would very early evince its importance to them; and accordingly the greatest among them have paid the utmost attention to it; and the chief and most essential discoveries in geometry in all ages, have been made in consequence of their efforts in this subject. Socrates thought that the prime use of geometry was to measure the ground, and indeed this business gave name to the subject; and most of the ancients seem to have had no other end besides *mensuration* in view in all their laboured geometrical disquisitions. Euclid's elements are almost entirely devoted to it; and although there be contained in them many properties of geometrical figures which may be applied to other purposes, and indeed of which the moderns have made the most material uses in various disquisitions of exceedingly different kinds, I say, notwithstanding this, yet Euclid himself seems to have adapted them entirely to this purpose: for, if it be considered that his elements contain a continued chain of reasoning, and of truths, of which the former are successively applied to the discovery of the latter, one proposition depending on another, and the succeeding propositions still approximating towards some particular object near the end of each book; and when at the last we find that object to be the equality, proportion, or relation between the magnitudes of figures both plane and solid; it is scarcely possible to avoid allowing this to have been Euclid's grand object. And accordingly he determined the chief properties in the mensuration of rectilineal plane and solid figures; and squared all such planes, and cubed all such solids. The only curve figures which he attempted besides are the circle and sphere; and when he could not accurately determine their measures, he gave an excellent method of approximating to them, by shewing how in a circle to inscribe a regular polygon which should not touch another circle, concentric with the former, although their circumferences should be ever so near together; and, in like manner, between any two concentric spheres to describe a polyhedron which

should not any where touch the inner one: and approximations to their measures are all that have hitherto been given. But although he could not square the circle, nor cube the sphere, he determined the proportion of one circle to another, and of one sphere to another, as well as the proportions of all rectilineal similar figures to one another.

Archimedes took up *mensuration* where Euclid left it, and carried it a great length. He was the first who squared a curvilineal space, unless Hypocrates must be excepted on account of his lunes. In his times the conic sections were admitted in geometry, and he applied himself closely to the measuring of them as well as other figures. Accordingly he determined the relations of spheres, spheroids, and conoids, to cylinders and cones; and the relations of parabolas to rectilineal planes whose quadratures had long before been determined by Euclid. He hath left us also his attempts upon the circle: he proved that a circle is equal to a right-angled triangle, whose base is equal to the circumference, and its altitude equal to the radius; and consequently that its area is found by drawing the radius into half the circumference; and so reduced the quadrature of the circle to the determination of the ratio of the diameter to the circumference; but which however hath not yet been done. Being disappointed of the exact quadrature of the circle, for want of the rectification of its circumference, which all his methods would not effect, he proceeded to assign an useful approximation to it: this he effected by the numerical calculation of the perimeters of the inscribed and circumscribed polygons; from which calculations it appears, that the perimeter of the circumscribed regular polygon of 192 sides is to the diameter, in a less ratio than that of $3\frac{1}{2}$ ($3\frac{10}{127}$) to 1, and that the inscribed polygon of 96 sides is to the diameter in a greater ratio than that of $3\frac{10}{127}$ to 1; and consequently much more that the circumference of the circle is to the diameter in a less ratio than that of $3\frac{1}{2}$ to 1, but greater than that of $3\frac{10}{127}$ to 1: the first ratio of $3\frac{1}{2}$ to 1, reduced to whole numbers, gives that of 22 to 7, for $3\frac{1}{2} : 1 :: 22 : 7$, which therefore will be nearly the ratio of the circumference to the diameter. From this ratio of the circumference to the diameter he computed the approximate area of the circle, and found it to be to the square of the diameter as 11 is to 14. He likewise determined the relation between the circle and ellipse, with that of their similar parts. The hyperbola too in all probability he attempted; but it is not to be hoped that he

met with any success, since approximations to its area are all that can be given by all the methods that have since been invented.

Besides these figures, he hath left us a treatise on the spiral described by a point moving uniformly along a right line, which at the same time moves with an uniform angular motion; and determined the proportion of its area to that of its circumscribed circle, as also the proportion of their sectors.

Throughout the whole works of this great man, which are chiefly on *mensuration*, he every where discovers the deepest design and the finest invention; and seems to have been (with Euclid) exceedingly careful of admitting into his demonstrations nothing but principles perfectly geometrical and unexceptionable: and although his most general method of demonstrating the relations of curved figures to straight ones, be by inscribing polygons in them, yet to determine those relations, he does not increase the number and diminish the magnitude of the sides of the polygon *in infinitum*; but from this plain fundamental principle, allowed in Euclid's elements, viz. that any quantity may be so often multiplied, or added to itself, as that the result shall exceed any proposed finite quantity of the same kind, he proves that to deny his figures to have the proposed relations, would involve an absurdity.

He demonstrated also many properties, particularly in the parabola, by means of certain numerical progressions, whose terms are similar to the inscribed figures; but without considering such series to be continued *in infinitum*, and then summing up the terms of such infinite series.

He had another very curious and singular contrivance for determining the measures of figures, in which he proceeds as it were mechanically by weighing them.

Several other eminent men among the ancients wrote on this subject, both before and after Euclid and Archimedes; but their attempts were usually upon particular parts of it, and according to methods not essentially different from theirs. Among these are to be reckoned Thales, Anaxagoras, Pythagoras, Bryson, Antiphon, Hypocrates of Chios, Plato, Apollonius, Philo, and Ptolemy; most of whom wrote of the quadrature of the circle, and those after Archimedes, by his method, usually extended the approximation to a greater degree of accuracy.

Many of the moderns have also prosecuted the same problem of the quadrature of the circle, after the same methods, to greater

lengths: such are Vieta, and Metius, whose proportion between the diameter and circumference is that of 113 to 355, which is within about $\frac{1}{1000000}$ of the true ratio; but above all, Ludolph van Ceulen, who with an amazing degree of industry and patience, by the same methods extended the ratio to 20 places of figures, making it that of 1 to 3.1415926535 8979323846 +.

The first material deviation from the principles used by the ancients in geometrical demonstrations was made by Cavalieri: the sides of their inscribed and circumscribed figures they always supposed of a finite and assignable number and length; he introduced the doctrine of indivisibles, a method which was very general and extensive, and which with great ease and expedition served to measure and compare geometrical figures. Very little new matter however was added to geometry by this method, its facility being its chief advantage. But there was great danger in using it, and it soon led the way to infinitely small elements, and infinitesimals of endless orders; methods which were very useful in solving difficult problems, and in investigating or demonstrating theories that are general and extensive; but sometimes led their incautious followers into errors and mistakes, which occasioned disputes and animosities among them. There were now however many excellent things performed in this subject; not only many new things were effected concerning the old figures, but new curves were measured; and for many things which could not be exactly squared or cubed, general and infinite approximating series were assigned, of which the laws of their continuation were manifest, and of some of which the terms were independent on each other. Mr. Wallis, Mr. Huygens, and Mr. James Gregory, performed wonders; Huygens in particular must be admired for his solid, accurate, and very masterly works.

During the preceding state of things, several men, whose vanity seemed to have overcome their regard for truth, asserted that they had discovered the quadrature of the circle, and published their attempts in the form of strict geometrical demonstrations, with such assurance and ambiguity as staggered and misled many who could not so well judge for themselves, and perceive the fallacy of their principles and arguments. Among those were Longomontanus, and our countryman Hobbs, who obstinately refused all conviction of his errors.

The use of infinites was however disliked by several people, particularly by Sir Isaac Newton, who among his numerous and great discoveries hath given us that of the method of fluxions; a discovery of the greatest importance both in philosophy and mathematics; it being a method so general and extensive, as to include all investigations concerning magnitude, distance, motion, velocity, time, &c. with wonderful ease and brevity; a method established by its great author upon true and incontestible principles; principles perfectly consistent with those of the ancients, and which were free from the imperfections and absurdities attending some that had lately been introduced by the moderns: he rejected no quantities as infinitely small, nor supposed any parts of curves to coincide with right lines; but proposed it in such a form as admits of a strict geometrical demonstration. Upon the introduction of this method most sciences assumed a different appearance, and the most abstruse problems became easy and familiar to every one; things which before seemed to be insuperable, became easy examples or particular cases of theories still more general and extensive; rectifications, quadratures, cubatures, tangencies, cases *de maximis & minimis*, and many other subjects, became general problems, and delivered in the form of general theories which included all particular cases: thus, in quadratures, an expression would be investigated which defined the areas of all possible curves whatever, both known and unknown, and which, by proper substitutions, brought out the area for any particular case, either in finite terms, or in infinite series of which any term or any number of terms could be easily assigned; and the like in other things. And although no curve, whose quadrature was unsuccessfully attempted by the ancients, became by this method perfectly quadrable, there were assigned many general methods of approximating to their areas, of which in all probability the ancients had not the least idea or hope; and innumerable curves were squared which were utterly unknown to them.

The excellency of this method revived some hopes of squaring the circle, and its quadrature was attempted with eagerness. The quadrature of a space was now reduced to the finding of the fluent of a given fluxion; but this problem however was found to be incapable of a general solution in finite terms: the fluxion of every fluent was always assignable, but the reverse of this problem could be effected

only in particular cases; among the exceptions, to the great grief of the geometers, was included the case of the circle, with regard to all the forms of fluxions attending it. Another method of obtaining the area was tried: of the quantity expressing the fluxion of any area, in general, could be assigned the fluent in the form of an infinite series, which series therefore defined all areas in general, and which, on substituting for particular cases, was often found to break off and terminate, and so afford an area in finite terms; but here again the case of the circle failed, its area still coming out an infinite series. All hopes of the quadrature of the circle being now at an end, the geometers employed themselves in discovering and selecting the best forms of infinite series for determining its area, among which it is evident that those were to be preferred which were simple, and which would converge quickly; but it generally happened that these two properties were divided, the same series very rarely including them both: the mathematicians in most parts of Europe were now busy, and many series were assigned on all hands, some admired for their simplicity, and others for their rate of convergency; those which converged the quickest, and were at the same time simplest, which therefore were most useful in computing the area of the circle in numbers, were those in which, besides the radius, the tangent of some certain arc of the circle, was the quantity by whose powers the series converged; and from some of these series the area hath been computed to a great extent of figures: Mr. Edmund Halley gave a remarkable one from the tangent of 30 degrees, which was rendered famous by the very industrious Mr. Abraham Sharp, who by means of it extended the area of the circle to 72 places of figures, as may be seen in Sherwin's book of logarithms; but even this was afterwards outdone by Mr. John Machin, who, by means described in Professor Hutton's *Mensuration*, composed a series so simple, and which converged so quickly, that by it, in a very little time, he extended the quadrature of the circle to 100 places of figures; from which it appears, that if the diameter be 1, the circumference will be 3.1415926535, 8979323846, 2643383279, 5028841071, 6939937510, 5820974944, 5923078164, 0628620899, 8628034825, 3421170679 +, and consequently the area will be 7853981633, 9744830961, 5660845819, 8757210492, 9234984377, 6455243736, 1480769541, 0157155224, 9657008706, 3355292669 +.

From

From hence it appears, that all or most of the material improvements or inventions in the principles or method of treating of geometry, have been made especially for the improvement of this chief part of it, *mensuration*; which abundantly shows, what I at first undertook to declare, the dignity of this subject; a subject which, as Dr. Barrow says, after mentioning some other things, "deserves to be more curiously weighed, because from hence a name is imposed upon that mother and mistress of the rest of the mathematical sciences, which is employed about magnitudes, and which is wont to be called *Geometry* (a word taken from ancient use, because it was first applied only to measuring the earth, and fixing the limits of possessions) though the name seemed very ridiculous to Plato, who substitutes in its place that more extensive name of *Metrics* or *Mensuration*; and others after him give it the title of *Pantometry*, because it teaches the method of measuring all kinds of magnitudes." See SURVEYING, LEVELLING, and GEOMETRY.

MINING, in *military affairs*, is the art of blowing up any part of a fortification, building, &c. by gun-powder. The art of *mining* requires a perfect knowledge both of fortification and geometry; that by these previous helps, the engineer may be qualified to inform himself in the nature of all manner of heights, depths, breadths, and thickneses; to judge perfectly of slopes and perpendiculars, whether they be such as are parallel to the horizon, or such as are visual; together with the true levels of all kinds of earth. To which must be added, a consummate skill in the quality of rocks, earths, masonry, and sands; the whole accompanied with a thorough knowledge of the strength of all sorts of gunpowder.

Names of every thing used in MINING.

Auget, a kind of small trough, made of strong inch boards, about 4 inches square, in which the saucisson is laid in straw, to prevent the powder from contracting any dampness.

Chamber, the place where the powder is lodged, being first put in cubical boxes made for that purpose.

Excavation, the pit or hole made by a mine.

Entonnoir, when sprung.

Focus, the centre of the chambre where the powder is lodged.

Fougast, a kind of small mine.

Fourneau. See **Chamber**.

Miners tools, are augers of several sorts, levers of different sorts, needles for working in rocks, rakes, spades, shovels, sledge-hammers, masons' hammers, pick-axes, picks, mattocks, chissels, plummets, rules, a miner's dial, &c.

Line of least resistance, is a line drawn from the centre of the space containing the powder, perpendicular to the nearest surface.

Gallery, the passage leading to the powder.

Saucisson, is a pipe or hose made of coarse cloth, whose diameter is about an inch, and filled with gun-powder; then laid in the trough or auget, which extends from the chamber to the entrance of the gallery, that the miner who sets fire to it, may have time to retire before it reaches to the chamber. See **Mine**, in the first Alphabet.

*** MOINEAU**, in *ancient irregular fortification*, a kind of flat bastion, raised on the centre of the curtain in old fortifications, when the bastions were at too great a distance from each other.

MORTARS. See this word in the first Alphabet.

Dimensions of all kinds of brass MORTARS, as established by the Board of Ordnance, in 1764.

	Nature	Length		Weight	Calibre of the mortar	Diameter of the shell	Chamber contains powder
		In.	F. In.	C. q. lb.	In.hun.	In.hun.	lb. oz.
Brass Mortars	13 S.	5	3	82 0 0	13.0	12.75	30 0
	10 S.	4	9	33 0 0	10.0	9.75	12 8
	13 L.	3	8	25 0 0	13.0	12.75	10 0
	10 L.	2	9	11 0 0	10.0	9.75	3 12
	8 L.	2	2	4 0 0	8.0	7.75	2 0
	5.8 R.	1	4	1 1 0	5.62	5.50	0 9
	4.5 C.	1	1½	0 3 0	4.52	4.40	0 5

N. B. The length is taken from the front or face of the muzzle, to the back of the base-ring, exclusive of the length of the cascade. **S.** stands for *sea-service mortar*, **L.** for *land-service mortar*, **R.** for *royal mortar*, and **C.** for *coeborn mortar*.

OFFICERS. See that word in the first Alphabet.

Marine OFFICERS, all those who command in that body of troops employed in the sea-service, under the direction of the lords of the admiralty.

* **ORB**, in *tactics*, is the disposing of a number of soldiers in circular form of defence. The *orb* has been thought of consequence enough to employ the attention of the famous marshal de Puyégur, in his *art of war*, who prefers this position, to throw a body of infantry in an open country, to resist cavalry, or even a superior force of infantry; because it is regular, and equally strong, and gives an enemy no reason to expect better success by attacking one place than another. Cæsar drew his whole army in this form, when he fought against Labienus. The whole army of the Gauls were formed into an *orb*, under the command of Sabinus and Cotta, when fighting against the Romans. The *orb* was generally formed 6 deep.

ORDERS, in a *military sense*, are of two sorts, viz.

General ORDERS, are such as are given out every day by the general who commands, who gives them in writing to the adjutant-general, who first sends exact copies to the general officers of the day, and distributes them at his own quarters to all the brigade majors, who daily go to head quarters for that purpose: there they write down every thing that is

dictated to them; from thence they go and give the *orders*, at the place appointed for that purpose, to the different majors or adjutants of the regiments which compose that brigade, who first read them to their colonels and lieutenant-colonels, and then dictate them to a serjeant of each company (this is more frequently done by the serjeant-major) who write them correctly down in their respective orderly-books, and bring them to all the officers belonging to the company.

Regimental ORDERS, are such as regard the regiment only, the same as the *general orders* regard the whole army. These orders are given out by the commanding-officer of each regiment.

Orderly non-commissioned officers, are those who are orderly, or on duty for that week; who, on hearing the drum beat for orders, are to repair to the place appointed to receive them, and to take down in writing, in the orderly-book, what is dictated by the adjutant or serjeant-major; they are then immediately to show those orders to the officers of the company, and afterwards warn the men for duty.

ORDER of the Bear, a military order in Switzerland, erected by the emperor Frederic II. in 1213, by way of acknowledgment for the service the Swiss had done him, and in favour of the Abbey of St. Gal. To the collar of the order hung a medal, on which was represented a bear, raised on an eminence of earth.

P

PARADE, in a *military sense*, the place where troops assemble, before they go on duty.

General PARADE, in *garrison*, is that place where the troops assemble, after marching from their officers quarters, and regimental *parade*.

Regimental PARADE, in *garrison*, is that place where the troops of each company assemble for duty, before they march to the *general parade*.

PARADE, in *camp*, is that spot of ground in the front of each incampment, between the camp-colours on the right and left wings. See **PARADE**, in the first Alphabet.

* **PARTUISAN.** See SPANTON.

* **PELATON.** See PLATOON.

PIONEERS. See this word in the first Alphabet. Each *pioneer* to have an axe, a saw, and an apron; a cap with a leather crown, and a black bear-skin front, on which is to be the king's crest in white, on a red ground; also an axe and a saw. The number of the regiment to be on the back part of the cap.

PLACE, in a *military sense*, is a general name for all kinds of fortified towns, forts, or fortresses, where a party may defend themselves.

P L A

A regular PLACE, is one whose angles, sides, lines, bastions, and other parts, are equal; generally called, from the number of its angles, a pentagon, hexagon, &c.

Irregular PLACE, is one whose sides and angles are unequal. See *PLACE*, in the first Alphabet, &c.

PLASTER, in *building*, a substance made of water and some absorbent matter, such as chalk or lime, well pulverised, with which walls are overlaid. It differs from common lime, in that it composes a solid body by itself, without mixing either sand or any other ingredient, as is done in lime. The best sort is made of a bluish soft stone, taken out of quarries, much like the stone of which Dutch terraces is made. This stone is burnt in the same manner as lime, and, when cold, beat into a fine powder; and when used, about a bushel is put into a tub, and water poured in, 'till it becomes liquid; then well stirred, and used immediately.

* *PLUGS*, in *artillery*, are either wood or cork, to stop the fuze-holes of shells.

PONT. See *BRIDGES*, in the first Alphabet.

Têtes de Pont. See *FIELD-FORTIFICATION*.

PRIMING, in *gunnery*, the train of powder

that is laid, from the opening of the vent, along the gutter or channel, on the upper part of the breech of the gun, which, when fired, conveys the flame to the vent, by which it is further communicated to the charge, in order to fire the piece. This operation is only used on ship-board, at the proof, and sometimes in garrison; for, on all other occasions, tubes are used for that purpose.

* *PRIMING-wire*, in *gunnery*, a sort of iron needle, employed to penetrate the vent or touch-hole of a piece of ordnance, when it is loaded, in order to discover whether the powder contained therein is thoroughly dry, and fit for immediate service; as likewise to search the vent and penetrate the cartridge, when the guns are not loaded with loose powder.

PYROTECHINY, in the *art of war*, is the doctrine of artificial fire-works and fire-arms: teaching both the use and construction of those used in war; such as gunpowder, cannon, mortars, howitzers, shells, shot, grape, grenades, carcasses, mines, small-arms, and all kinds of military fire-works; with the art of founding guns, &c.

Q

QUARTER-guard. See *GUARD*, in the first Alphabet.

The *quarter-guard* is always commanded by a subaltern officer, and consists of about 20 or 30 men, whose duty it is to maintain good order in the camp. This guard now fronts outwards, though it was formerly the custom to front inwards, that is, to face the battalion;

and as this guard is merely to maintain good order in the camp, the present alteration seems improper. The *quarter-guards* of all foreign troops front inwards. Those who wish to be well acquainted with guards, and encampments, will find satisfaction in Lochée's useful *Essay on Castrametation*.

R

* *RAVES*, in *artillery carriages*, are the upper wooden bars in a cart or waggon, supported by the round and flat staves which enter into them.

REAR-guard. See *GUARD*, in the first Alphabet.

REAR-guard, is always commanded by a non-commissioned officer, generally a corporal, and 6 or 8 men. This guard serves to keep good

order in the rear of the camp, and has, 'till of late, fronted inwards; and the reason of its now fronting outwards is, in my humble opinion, improper.

REGIMENT of artillery. See *ARTILLERY*, in the first Alphabet.

* *RHOMBUS*, in *geometry*, an oblique-angled parallelogram, or a quadrilateral figure whose sides are equal and parallel, but the angles

gles unequal; two of the opposite ones being obtuse, and the other two acute.

* RHOMBOIDES, in *geometry*, a quadrilateral figure whose opposite sides and angles are

equal, but is neither equilateral nor equangular.

ROSE-buds. See NAILS, in the first Alphabet.

S

* SALLY-ports, in *fortification*, or *postern-gates*, as they are sometimes called, are those under-ground passages, which lead from the inner works to the outward ones; such as from the higher flank to the lower, or to the tennails, or the communication from the middle of the curtain to the ravelin. When they are made for men to go through only, they are made with steps at the entrance, and going out. They are about 6 feet wide, and $8\frac{1}{2}$ feet high. There is also a gutter or shore made under the sally-ports, which are in the middle of the curtains, for the water which runs down the streets to pass into the ditch; but this can only be done when there are wet ditches.

When sally-ports serve to carry guns through them for the out-works, instead of making them with steps, they must have a gradual slope, and be 8 feet wide.

SASHES, in *military dress*, are badges of distinction, worn by the officers of most nations, either round their waist, or over their shoulders. Those for the English army are made of crimson silk; for the Imperial army, crimson and gold; for the Prussian army, black silk and silver; the Hanoverians, yellow silk; the Portuguese, crimson silk with blue tassels.

SENTINELS. See this word in the first Alphabet.

All *sentinels* are to be vigilant on their posts; neither are they to sing, smoke tobacco, nor suffer any noise to be made near them. They are to have a watchful eye over the things committed to their charge. They are not to suffer any light to remain, or any fire to be made near their posts in the night-time; neither is any *sentry* to be relieved, or removed from his post, but by the corporal of the guard. They are not to suffer any one to touch or handle their arms, or in the night-time to come within 10 yards of their post.

No person is to strike or abuse a *sentry* on his post; but when he has committed a crime, he is to be relieved, and then punished according to the rules and articles of war.

A *sentinel*, on his post in the night, is to know nobody, but by the countersign: when challenges, and is answered, *Relief*, he calls out, *Stand, relief! advance, corporal!* upon which the corporal halts his men, and advances alone within a yard of the *sentry's* firelock (first ordering his party to rest, on which the *sentry* does the same) and gives him the countersign, taking care that no one hear it.

* SEWER, in *military architecture*, a drain, conduit, or conveyance, for carrying off water filth, &c. It is necessary that every building have conveniences for discharging its refuse water, and other useless and offensive matters: these are obtained by digging and laying *sewers* and drains at proper depths, and with the needful outlets: the great care is, that they be large enough; that they be placed deep enough, and have a proper descent; that they be well arched over, and have so free a passage, that there be no danger of their choaking up; the cleaning them being a work of trouble and expence.

Instead of making the bottom of the *sewer* a flat floor, let it be in form of an inverted arch, answering in part to the sweep of the arch above. Every one knows that the freest passage that can be, is through circular channels; and these would sufficiently wear that form; they would in a manner resemble so many vast water-pipes of a circular base, and there would be no danger of their filling up. The perpendicular walls would detain nothing, because there are no angles in their joining; and the bottom being round and free, all would run off easily as it should.

SHELLS. See this word in the first Alphabet.

To find the weight of a SHELL. *Rule.* Double the difference of the diameters of the shell and hollow sphere, and 7 times the result gives the weight in pounds, cutting off the two right-hand figures of whole numbers.

Example. Let the diameter of the shell be 13 inches, and that of the hollow sphere 9.5. Then the cube of 13 is 2197, and that of 9.5 is 857.357; the difference is 1339.625, its double is

S H O

is 2679.25, which multiplied by 7, gives 18754.625; and cutting off two places in whole numbers, the result is 187 lb. or 1 cwt. 2 qrs. 21 lb. the weight of the shell.

SHOT. See this word in the first Alphabet.

To find the weight of an iron SHOT, whose diameter is given; and the contrary. **Rule.** Double the cube of the diameter in inches, and multiply it by 7; so will the product (rejecting the 2 last or right-hand figures) be the weight in pounds.

Example. What is the weight of an iron shot of 7 inches diameter? The cube of 7 is 343, which doubled is 686, and this multiplied by 7 produces 4802, which, with the right-hand figures rejected, gives 48 pounds, the weight required.—N. B. This rule is sufficiently exact for practical uses.

To find the diameter of the SHOT, when the weight is given. **Rule.** Multiply the cube root of the weight in pounds by 1.923, and the product is the diameter in inches.

Example. What is the diameter of an iron shot of 52 pounds? The cube root of 52 is 3.732, which multiplied by 1.923 gives 7.177 inches, the diameter required.

Rule by logarithms.

To $\frac{1}{3}$ of the log. of 52 - - 0.572001
Add the constant log. - - 0.283979

And the sum is the log. of the } 0.855980
diameter 7.177 - - -

To find the diameter of a SHOT, from the impression or cavity it makes by striking a brass gun, or other object. **Rule.** Divide the square of the radius of the cavity by the depth of it, and add the quotient to the depth; so will the sum be the diameter of the shot required.

Example. A shot having struck upon a brass gun, made a cavity of 1.49 inches deep, and 4.94 inches diameter; what was the size of the shot? The radius of the cavity is 2.47, and its square is 6.1009, which divided by the depth 1.49, the quotient is 4.1, to which adding 1.49, the sum 5.59 inches is the diameter required, answering to a 24-pounder.

SIGNALS by the drum, made use of in exercise, instead of the word of command, viz.

SIGNALS by the drum. **Operations.**

A short roll, - To caution.
A flam, - - { To perform any distinct thing.
To arms, - To form the line or battalion
The march, - { To advance, except when intended for a salute.

The quick march, - To advance quick.
The point of war, - To march and charge.
The retreat, - - To retreat.
Drum ceasing, - - To halt.
Two short rolls, - To perform the flank firing
The dragoon march, To open the battalion.
The grenadier march, To form the column.
The troop, - - To double divisions.
The long roll, - - To form the square.
The grenadier march, { To reduce the square to the column.
The preparative, - To make ready and fire.
The general, - - To cease firing.
Two long rolls, { To bring or lodge the colours.

SIGNS, in the art of war, certain signs by which the intention of the enemy may be discovered. The most infallible indication of the enemy's designs, previous to his taking the field, is the place where he deposits his magazines.

When an army intends to march, it is a general custom to cook their kettles on that day particularly. If therefore you perceive, at 5 or 6 o'clock in the morning, more smoke than ordinary in their camp, you are pretty certain they intend to move.

When an army intends to fight, it is a general custom to call in all their large detachments of light troops; therefore, when you see this, you must be upon your guard.

If you have always the same general to contend with, you will in time be able, by repeated observations on his disposition and manner of acting, to foresee his designs.

* **SLATE**, in military architecture, a kind of bluish fossil stone, very soft when dug out of the quarry, and therefore easily slit or sawed into thin long squares, to serve instead of tiles for the covering of all kinds of military buildings, &c.

* **SLUICES**, in military architecture, are made for various purposes; such as to make rivers navigable; to join one river to another, which is higher or lower, by means of a canal; to form inundations upon particular occasions, or to drain spots of ground that are overflowed by high tides: they are also made in fortresses, to keep up the water in one part of the ditches, whilst the other is dry; and to raise an inundation about the place when there is any apprehension of being attacked.

SLUICES are made different ways, according to the uses they are intended for: when they serve for navigation, they are shut with two gates presenting an angle towards the stream; when

when they are made near the sea, two pair of gates are made, the one pair to keep the water out, and the other in, as occasion may require: in this case, the gates towards the sea present an angle that way, and the others the contrary way. The space inclosed by these gates is called *chamber*.

When *sluices* are made in the ditches of a fortress to keep up the water in some parts, instead of gates, shutters are made, so as to slide up and down in gutters, or grooves; and when they are made to raise an inundation, they are then shut by means of square timbers let down into *cullises*, so as to lie close and firm. Particular care must be taken in the building of a *sluice*, to lay the foundation in the securest manner; that is, to lay the timber, grates, and floors, in such a form, that the weather cannot penetrate through any part, otherwise it will undermine the work, and blow it up, as it has sometimes happened: lastly, to make the gates of a proper strength in order to support the pressure of the water, and yet to use no more timber than what is necessary. Those who wish to be thoroughly acquainted with this kind of work, may meet with satisfaction in *L'Architecture Hydraulique, par M. Belidor*, or in Mr. Millar's *Practical Fortification*.

SURVEYING, in *military mathematics*, the art or act of measuring lands; that is, of taking the dimensions of any tract of ground, laying down the same in a map or drawing, and finding the content or area thereof.

Surveying, called also *geodesy*, is a very ancient art; it is even held to have been the first or primitive part of geometry, and that which gave occasion to, and laid the foundation of all the rest.

Surveying consists of three parts: the first, the taking of the necessary measures, and making the most necessary observations, on the ground itself; the second is, the laying down of these measures and observations on paper; and the third, the finding the area or quantity of the ground there laid down. The first is what we properly call *surveying*; the second we call *plotting*, *protracting*, or *mapping*; and the third, *casting up*.

The first, again, consists of two parts, viz. the making of observations for the angles, and the taking of measures for the distances. The former of these is performed by some one or other of the following instruments, viz. the theodolite, circumferentor, semi-circle, plain table, or compass. The latter is performed by means either of the chain, or perambulator.

The second branch of *surveying* is performed by means of the protractor, and plotting scale. The third, by reducing the several divisions, inclosures, &c. into triangles, squares, trapeziums, parallelograms, &c. but especially triangles; and finding the areas or contents of these several figures. See Love's *Geodesia*, and Wyld's *Practical Surveyor*.

T

TABLE of all the different dimensions for iron TAMPIONS used in sea-service grape shot.

Natures Pounders	Bottom		Spindle	
	Diameter Inches	Thickness Inches	Height Inches	Thickness Inches
42-pounder	6.6	0.6	9.3	0.7
32 ditto	6.0	0.6½	8.3	0.8
24 ditto	5.4	0.6	7.3	0.9
18 ditto	4.9	0.6½	6.5	0.7
12 ditto	4.3	0.5	5.5½	0.6
9 ditto	3.9	0.4½	5.4	0.4
6 ditto	3.4	0.4½	4.4	0.4
4 ditto	2.9	0.4	4.1	0.3
3 ditto	2.4	0.5	3.6	0.3
1½ ditto	2.1	0.3	3.2	0.2
¾ ditto	1.4	0.2	2.0	0.1½

T A B

TABLE of experiments to find the best length of GUNS, and their FITTEST CHARGES, deduced from actual trials, 1775.

Nature	Heavy			Mediums			Light			Powder	Elevation	Range				
	Length	Weight		Length	Weight		Length	Weight								
Pdrs.	F.	In.	C.	q.	lb.	F.	In.	C.	q.	lb.	lb.	oz.	°	Yds.		
42	9	6	61	2	10						21		6	2368		
	10		62	1	18						14		6	2295		
	10	6	62	2	25						14		6	2189		
32	10		55	2	7						16		5 30	2043		
	9	2	52	1	18						10	12	5	2103		
	8		50	2	19						10	12	5 30	2118		
24	11		51	0	5						12		5 30	2212		
	9		39	1	3						8		5	2186		
	9		39	1	3						8		5	2218		
12	8		19	2	0						6		4 30	1780		
	8		19	2	0						4		4	1637		
	8		19	2	0						4		4	1652		
24						8	5	40	2	0		12	5 30	1750		
						8		40	1	0		8	5	1830		
						8		40	1	0		8	5	1863		
12									5	6	8	3	18	6	4 30	1203
									5		8	3	18	4	4	1189
									5		8	3	18	4	4	1216
6									4	6	4	3	14	3	5	1097
									4	6	4	3	14	2	5	1098
									4	6	4	3	14	2	5	1107
3									3	6	2	3	4	1 8	4 30	938
									3	6	2	3	4	1	4 30	943
									3	6	2	3	4	1	4 30	956

These experiments were the result of the mediums of 8 rounds to each; from whence it appears, that when the pieces were loaded with half the weight of the shot, the ranges were greater than when loaded with either more or less, except in the smaller calibres, where 1-3d seems to be the best charge. Again, the pieces of 9 feet long, carried farther than those of 10 feet 6 inches, and 11 feet, &c.

TABLE

T A B

TABLE of experiments with GRAPE-SHOT against a curtain 39 feet long, and 8 feet high, in 1773.

Ordnance			Weight of		Greatest effect at 200 yards		Greatest effect at 300 yards	
Caliber	Length	Weight	Powder	Grape	Decimal parts of the char.	Weight of shot through	Decimal parts of the char.	Weight of shot through
	F. in.	C. q. lb.	lb. oz.	lb. oz.				
H. 6-pound.	8 0	18 3 13	4 9	9 14	.31	3.4lb.	.33	3.3lb.
H. 6-pound.	8 0	18 3 13	3 2	5 8	.31	2.6	.22	1.2
H. 6-pound.	8 0	18 3 13	2 0	9 14	.33	2.7	.22	2.4
H. 6-pound.	8 0	18 3 13	2 0	5 8	.32	2.5	.29	1.6
L. 6-pound.	4 6	4 15 2	2 0	9 14	.34	3.4	.2	2.9
L. 6-pound.	4 6	4 15 2	1 8	5 8	.39	2.1	.38	2.0
L. 6-pound.	4 6	4 15 2	2 0	5 8	.38	2.6	.37	2.2
3-pounder	3 6	2 2 19	1 0	5 0	.42	2.0	.30	1.5
3-pounder	3 6	2 2 19	0 12	5 0	.62	1.8	.40	1.2
3-pounder	3 6	2 2 19	0 12	5 0	.58	1.6	.41	1.3
8-in. howit.	2 1½	11 3 0	3 0	38 4	.55	20.0	.27	10.0
8-in. howit.	2 1½	11 3 0	3 0	38 4	.57	18.7	.29	12.6
8-in. howit.	2 1½	11 3 0	3 0	38 4	.59	22 8	.36	11.8
5½-in. how.	1 6	4 0 0	1 0	13 8	.27	3.6	.22	3.0
5½-in. how.	1 6	4 0 0	1 0	13 8	.29	3 8	.23	3.5
5½-in. how.	1 6	4 0 0	1 0	13 8	.33	3.10	.22	3.7

In this table the 5 first columns are easily understood. By *greatest effect* is meant the effect of the best round in 4, which was fired each at ½ a degree elevation, beginning at 0 degree, and that effect (or number through the curtain) is expressed in decimal parts of the whole charge of grape. Hence .33 in the last column but

one, means .33 hundredth parts of 9 lb. 14 oz. = 3.3 lb. nearly, and so of the rest: so that, if such experiments were sufficiently pursued, these numbers would exhibit the comparative powers or fitness of each different kind of piece for grape-shot. N. B. *H.* means *heavy*, and *L.* *light* guns.

TABLE

I A B

T A B

TABLE of experiments with a light brass 6-pounder, with case-shot; length 4 feet 7 inches, weight 5 c. oqr. 18 lb. with 72 shot, being single proportion, and 144, double proportion in each case; weight of each shot $1\frac{1}{4}$ oz. against a target 300, and 400 yards distance. Weight of shot and bottoms 6 and 12 lb.

Powder	Elevation	Length of charge from muzzle	Recoil	Target		Total thro' and hit	Mediums thro' and hit	Shot spread from centre to		No. of shot in each case	Distance	Remarks
				Through	Hit			Right	Left			
lb. oz. d. m.	° ' "	ft. in.	ft. in.	un. ov.	un. ov.	No.	No.	Yds. ft.	Yds. ft.	No.	Yards	
1 4 1 0	3 3	2 9	4 1	27	5 37	37	17	2 15	1	72	300	Single proportion. Short bottoms.
1 4 1 0	3 3	3 7	1 0	29	9 39	37	14	2 31	2			
1 4 1 0	3 3.5	3 8	3 1	23	7 34	37	22	2 17	0			
1 12 1 0	3 3.7	6 0	4 3	24	5 36	33	17	2 20	0			
1 12 1 0	3 3	6 6	7 6	19	3 35	33	15	0 30	0			
1 12 1 0	3 3	6 4	6 4	12	6 28	33	12	1 18	0			
1 4 1 0	2 10.5	5 4	4 3	30	13 50	69	12	1 32	0	144	300	Double proportion. Short bottoms.
1 4 1 0	2 10.5	6 2	12 12	33	12 89	69	16	2 29	2			
1 4 1 0	2 10.5	5 10	8 3	50	9 70	69	20	0 30	2			
1 12 1 0	2 9.3	12 5	19 13	35	9 76	73	13	2 27	0			
1 12 1 0	2 9.3	9 9	14 14	35	14 67	73	16	1 29	1			
1 12 1 0	2 9.3	11 3	18 9	36	12 75	73	16	1 25	1			
1 4 1 30	3 3.5	4 8	5 2	17	10 34	31	11	1 31	1	72	400	Single proportion. Short bottoms.
1 4 1 30	3 3.5	3 9	3 0	16	6 25	31	12	1 26	0			
1 4 1 30	3 3.5	4 10	6 4	16	7 33	31	15	0 20	1			
1 12 1 30	3 2	5 11	7 0	20	6 33	24	11	0 31	1			
1 12 1 30	3 2.7	5 5	2 2	13	3 20	24	16	1 19	0			
1 12 1 30	3 2.7	6 3	1 0	11	6 18	24	23	1 29	0			
1 4 1 30	2 10.5	5 5	0 0	8	3 11	18	9	1 31	1	144	400	Double proportion. Short bottoms.
1 4 1 30	2 10.7	6 0	2 1	14	8 25	18	19	0 32	0			
1 4 1 30	2 10.3	5 6	1 0	12	5 18	18	13	1 32	0			
1 12 1 30	2 9.5	8 7.5	5 1	14	4 24	19	23	2 31	0			
1 12 1 30	2 9.3	10 6.5	0 0	15	6 21	19	12	1 31	1			
1 12 1 30	2 9.5	9 9.5	0 0	10	3 13	19	18	1 31	0			

TABLE

T A F

T A B

TABLE of experiments with a medium brass 6-pounder, with case-shot; length 7 feet 2 inches, weight 10 c. 3 qr. 0 lb. with 72, 144, and 216 shot in each case, being single, double, and triple proportions, weight of each shot $1\frac{1}{4}$ oz. against a target 300, and 400 yards distance; weight and bottoms 6, 12, and 18 lb. Woolwich, 1777.

Powder	Elevation	Length of charge from the muzzle	Recoil	Target								Shot spread from centre to				Shot in each case	Distance	Remarks		
				Through		Hit		Total through and hit	Mediums thro' and hit	Right	Left									
				under	over	under	over					No.	No.	yds. F.	yds. F.					
lb. oz.	D. M. F.	In. F. In.	F. In.											No.	yards					
2	8	1	0	5	8	8	6	23	3	10	3	30	36	18	0	10	0	72	300	Single proportion. Short bottoms.
				5	8	9	6	10	6	10	5	31	36	15	0	15	0			
				5	8	9	3	21	2	10	5	38	36	15	0	21	0			
				5	5	15	4	19	10	3	6	33	33	23	0	30	0			
				5	5	17	0	18	4	7	0	29	33	15	1	17	0			
3	8	1	0	5	5	17	10	21	4	5	2	32	33	8	0	28	0	144	300	Double proportion. Short bottoms.
				5	3	16	0	12	7	22	7	48	56	22	1	21	0			
				5	3	18	0	21	3	23	10	57	56	15	0	25	0			
				5	3	18	0	21	8	22	10	61	56	23	2	22	0			
				5	1	26	0	23	4	25	7	59	59	21		20	0			
2	8	1	0	5	1	27	6	28	12	15	3	58	59	13	1	22	0	216	300	Triple proportion. Short bottoms.
				5	1	27	0	22	6	11	12	59	59	16	1	22	0			
				4	10	24	0	28	8	31	10	77	75	24	0	30	0			
				4	10	21	6	17	10	33	11	71	75	26	1	19	0			
				4	10	21	0	23	10	28	12	73	75	21	1	22	0			
3	8	1	0	4	8	28	6	19	10	29	18	76	74	24	1	25	0	72	400	Single proportion. Short bottoms.
				4	8	28	6	34	9	28	12	88	74	23	0	20	0			
				4	8	29	0	29	13	20	11	73	74	19	0	26	0			
				5	8	7	6	2	1	22	9	34	37	18	1	28	0			
				5	8	8	9	14	3	14	7	38	37	15	2	10	0			
2	8	1	30	5	8	9	1	11	4	18	5	33	37	17	0	28	0	144	400	Double proportion. Short bottoms.
				5	5	12	8	8	5	12	1	26	28	21	1	13	0			
				5	5	12	7	13	6	15	3	37	28	13	0	23	0			
				5	5	12	3	6	7	6	3	22	28	23	0	30	2			
				5	3	6	6	2	3	20	15	40	45	20	1	22	1			
3	8	1	30	5	3	6	8	4	5	26	19	46	45	26	1	21	1	216	400	Triple proportion. Short bottoms.
				5	3	6	7	6	3	27	11	47	45	21	1	21	0			
				5	1	26	0	4	2	35	8	49	53	23	0	24	0			
				5	1	28	0	11	7	25	7	50	53	27	0	22	0			
				5	1	36	0	11	5	35	7	56	53	21	1	27	2			
2	8	1	30	4	8	12	7	12	4	36	6	50	66	25	1	20	0	72	400	Single proportion. Short bottoms.
				4	8	12	7	3	1	47	16	67	66	20	0	31	2			
				4	8	13	6	14	3	43	14	74	66	23	1	22	0			
				4	7	36	0	7	0	19	5	31	49	18	1	29	1			
				4	7	40	0	7	5	21	6	39	49	16	0	23	1			
3	8	1	30	4	7	36	0	14	3	41	11	69	49	24	0	23	1	144	400	Double proportion. Short bottoms.

TABLE

T A B

T A B

TABLE of experiments with a heavy brass 12-pounder, with case-shot; length 9 feet; weight 31 c. 1 qr. 16 lb. with 84 shot in each case; weight of each shot 2 oz. against a target 400 yards distance. Weight of shot and bottom 12 lb. 178.

Powder	Elevation	Length of charge from the muzzle	Recoil	Target								Shot spread from the centre to				Shot in each case	Distance	Remarks
				Through		Hit		Total through and hit		Mediums thro' and hit		Right		Left				
				under	over	under	over	No.	No.	No.	No.	Yds. F.	Yds. P.	No.	Yard.			
6	2	0	6 9.6	4 6	11	8	4	2	25	25	14	0	14	1	84	400	Common bottoms.	
			6 9.6	5 0	13	9	4	2	28	25	24	0	22	0				
			6 9.6	5 0	11	5	6	4	26	25	17	0	15	0				
			6 10.2	5 0	12	5	4	3	24	25	10	0	18	2				
			6 10.1	4 6	9	4	8	2	23	25	25	0	17	1				
			6 10.1	4 6	15	5	4	0	24	25	16	2	11	1				
	2	15	6 11	6 0	17	4	4	0	25	27	16	0	27	1	84	400	Short bottoms.	
			6 11	5 0	13	6	9	0	28	27	17	2	9	0				
			6 10.6	5 6	22	5	3	2	32	27	17	2	19	1				
			6 11	5 0	17	1	8	3	29	27	13	1	20	1				
			6 10.5	5 6	16	2	5	0	23	27	24	2	7	0				
			6 11	5 6	11	8	4	1	24	27	12	2	14	2				
6	2	0	6 10	8 1	22	7	10	3	42	32	19	0	25	0	84	400	No bottoms.	
			6 9	8 2	17	4	8	4	33	32	21	2	21	0				
			6 10	8 4	16	6	11	0	33	32	27	1	16	0				
			6 9	8 0	13	6	4	3	26	32	16	2	7	2				
			6 9	8 6	11	6	5	0	22	32	20	1	25	0				
			6 9	8 5	23	3	6	2	34	32	21	1	23	1				
	2	15	6 11	8 9	24	9	3	3	39	33	18	2	19	0	84	400	Common bottoms.	
			6 9	8 7	17	9	4	2	32	33	21	0	26	2				
			6 10	8 4	11	14	3	0	28	33	22	1	14	2				
			6 10	8 8	17	8	4	2	31	33	23	1	11	1				
			6 10	8 3	17	9	4	3	33	33	23	2	14	1				
			6 11	8 4	16	5	5	3	29	33	20	1	12	1				
7	2	0	7 0	10 8	14	7	5	5	31	34	14	2	19	0	84	350	Short bottoms.	
			7 1	11 0	13	11	7	1	32	34	22	2	19	2				
			7 0	10 8	16	5	2	0	23	34	3	1	12	0				
			7 0	10 8	20	14	3	4	41	34	28	0	19	0				
			7 1	11 3	17	8	7	2	34	34	24	1	19	1				
			7 1	11 2	20	8	10	2	40	34	20	0	21	1				
	2	30	6 9.4	11 3	13	7	6	0	26	27	8	0	25	0	84	550	No bottoms.	
			6 10.5	11 3	16	2	3	1	22	27	24	0	17	0				
			6 9.5	11 5	14	10	1	0	25	27	24	2	17	0				
			6 9	11 4	14	13	2	1	30	27	12	1	16	0				
			6 9.5	11 4	17	6	6	1	30	27	20	2	12	1				
			6 9.7	11 5	16	10	1	2	29	27	16	0	19	0				

TABLE

T A B

T A B

TABLE containing the greatest ranges of the several Howitzer, with different charges and elevations, deduced from actual experiments.

Elevation	CALIBRE 8 in. shell 42lb. chamb. holds 3lb. 8 oz. shell 2½lb. Greatest range 1800 yards.			ROYAL 5.8 shell 15lb. chamber holds 1lb. shell 14oz. Greatest range 1600 yards.			COEHORN 5.5 shell 8lb. cha. holds 8 oz. shell 7 oz. Greatest range 900 yards.			Time of flight.	Length of fuze.	Greatest range with the given charge.
Deg. Min.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	seconds	inches	yards
7 30	0	4	12	0	2	4	0	1	8	1.46	0.18	120
8 0	0	5	8	0	2	7	0	1	11	1.49	0.21	128
8 30	0	6	4	0	2	10	0	1	14	1.62	0.30	136
9 0	0	7	0	0	2	13	0	2	0	1.78	0.32	150
9 30	0	7	12	0	3	0	0	2	4	1.83	0.46	180
10 0	0	8	8	0	3	4	0	2	7	2.10	0.70	216
10 30	0	9	4	0	3	8	0	2	10	2.79	0.72	248
11 0	0	10	0	0	3	12	0	2	13	3.10	0.89	306
12 0	0	10	12	0	4	0	0	3	0	3.19	0.98	343
13 0	0	11	8	0	4	4	0	3	6	3.68	1.08	382
14 0	0	12	4	0	4	8	0	3	12	4.10	1.22	418
15 0	0	13	0	0	4	12	0	4	0	4.75	1.26	480
8 0	0	13	12	0	5	0	0	4	8	3.04	0.88	210
9 0	0	14	8	0	5	4	0	5	0	3.19	0.94	328
10 0	0	15	4	0	5	9	0	5	8	3.58	0.93	360
11 0	1	0	0	0	5	13	0	6	0	3.74	1.04	389
12 0	1	4	0	0	6	10	0	6	8	4.60	1.18	467
13 0	1	8	0	0	6	7	0	7	0	5.12	1.46	648
14 0	1	12	0	0	6	12	0	7	8	6.54	1.49	792
15 0	2	0	0	0	7	10	0	8	0	7.12	2.48	900
8 0	2	4	0	0	7	10				7.10	3.33	962
10 0	2	8	0	0	8	0				.13	3.68	1136
12 0	2	12	0	0	10	0				9.21	3.80	1242
14 0	3	0	0	0	12	0				9.60	3.92	1308
15 0	3	4	0	1	0	0				10.10	4.32	1600
16 0	3	8	0							11.48	4.62	1800

This TABLE will be of great service to the young officer, who has not a collection of experiments, nor seen much practice.

T A B

T A B

TABLE of practice, with the following *brass* ordnance. Woolwich, 1777.

Ordnance			Powder	Elevation		Recoil	Target's distance	Shot went to				Remarks
Nature	Length	Weight		D. M.	F. In.			Right	Left	Under	Over	
Pounders	F. In.	C. q. lb.	lb. oz.				yards	F. In.	F. In.	F. In.	F. In.	
Heavy 12	9	0 29 3 36	0	0	30	12	530	2	0		3	Through the target
				0	40	10		5	0	0	6	
				0	40	11			6	0	2	
				0	50	10		1	6	1	3	
Medium 12	6	6 21 1 11 4	8	1	0	11	400	2	0	7	0	Near the target
				1	0	9			8	0	8	
				0	30	11			5	0	2	
				0	30	11			6	3	0	
Light 6	4	6 5 0 26 1	8	0	15	13	300	0	6		3	Through the target
				0	0	15			1	6	0	
				0	15	19						
				0	30	16		1	4			
Heavy 12	9	0 29 3 36	0	0	30	8	530	6	0		2	Through the target
				0	30	10			9	0	4	
				0	35	9		7	0	6	0	
				0	35	8		3	4	3	5	
Medium 12	6	6 21 1 14 4	8	0	30	7	400	2	6		1	Through the target
				0	30	8		2	0		6	
				0	35	7		1	0	6	6	
				0	35	7						
Light 6	4	6 5 0 26 1	8	0	15	8	300	6	0		2	Through the target
				0	15	8		1	6		2	
				0	15	8		2	6	1	6	
				0	15	8		1	5	3	6	
Medium 12	6	6 21 1 14 4	8	0	15	12	400	7	0	3	0	Through the target
				0	15	13			1	0	2	
				0	15	13			2	6	1	
				0	15	13		3	6		3	
Light 6	4	6 5 0 26 1	8	0	30	14	300		0	6	0	Through the target
				0	30	13			4			
				0	15	13		4	0	1	6	
				0	15	13		3	6	3	6	
Heavy 12	9	0 29 3 36	0	1	0	10	400	2	0	6	0	Through the target
				1	0	10					4	
				1	0	10		4	0	2	6	
				1	0	10			1	0	2	

N. B. The first 12 rounds the shot were fixed to wooden bottoms; the second 12 rounds the shot were not fixed to wooden bottoms. All the rest had wooden bottoms.

TABLE

T A B

T A B

TABLE, containing the greatest ranges of the several land mortars with different charges, deduced from actual experiments. 1773.

CALIBRE 13 inches, shell 20½ lb. chamb. holds 8 lb. shell 9 lb. Greatest range 2500 yards.			CALIBRE 10 inches, shell 9½ lb. chamb. holds 5½ lb. shell 3½ lb. Greatest range 3000 yards.			CALIBRE 8 inches, shell 42 lb. chamb. holds 2½ lb. shell 2½ lb. Greatest range 1800 yards.			ROYAL. Calibre 5½ inches, shell 15 lb. cha. 9 oz. shell 14 oz. Greatest range 1500 yards.			COEHORN. Calibre 4½ lb. shell 8 lb. cha. 4½ oz. shell 7 oz. Greatest range 900 yards.			Time of flight	Length of f. ze.		Greatest range with the given charge	Square roots of the greatest range.
lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	Sec.	inch.	yd.	yards.		
0 7 0	0 5 8	0 4 12	0 2 4	0 1 8	4.37	10.9	100	10											
0 10 0	0 7 0	0 5 8	0 2 7	0 1 11	5.28	1.32	150	12.25											
0 13 0	0 8 8	0 6 4	0 2 10	0 1 14	6.20	1.55	200	14.14											
1 0 0	0 10 0	0 7 0	0 2 13	0 2 1	6.80	1.70	250	15.81											
1 3 0	0 11 7	0 7 12	0 3 0	0 2 4	7.50	1.88	300	17.32											
1 6 0	0 12 14	0 8 8	0 3 4	0 2 7	8.12	2.03	350	18.71											
1 9 0	0 14 5	0 9 4	0 3 8	0 2 10	9.68	2.15	400	20											
1 12 0	0 15 12	0 10 0	0 3 12	0 2 13	10.12	2.28	450	21.21											
1 14 8	1 1 3	0 10 12	0 4 0	0 3 0	10.60	2.42	500	22.36											
2 1 0	1 2 10	0 11 8	0 4 4	0 3 3	11.00	2.53	550	23.45											
2 3 8	1 4 1	0 12 4	0 4 8	0 3 6	11.40	2.65	600	24.5											
2 6 0	1 5 8	0 13 0	0 4 12	0 3 9	11.84	2.75	650	25.5											
2 8 8	1 6 15	0 13 12	0 5 0	0 3 12	12.20	2.85	700	26.46											
2 10 10	1 8 6	0 14 8	0 5 4	0 3 15	12.64	2.96	750	27.29											
2 12 12	1 9 13	0 15 4	0 5 9	0 4 2	13.00	3.05	800	28.29											
2 14 14	1 11 4	1 0 0	0 5 13	0 4 5	13.32	3.16	850	29.16											
3 0 0	1 12 11	1 0 12	0 6 1	0 4 8	13.72	3.25	900	30											
3 2 2	1 14 2	1 1 8	0 6 7		14.00	3.33	950	30.82											
3 6 0	1 15 9	1 2 4	0 6 12		14.40	3.43	1000	31.63											
3 8 8	2 1 0	1 3 0	0 7 1		14.72	3.50	1050	32.40											
3 11 0	2 2 7	1 3 12	0 7 6		15.00	3.60	1100	33.16											
3 13 8	2 3 14	1 4 8	0 7 11		15.28	3.68	1150	33.92											
4 0 0	2 5 5	1 5 4	0 8 0		15.60	3.75	1200	34.64											
4 2 8	2 6 12	1 6 0	0 8 4		15.84	3.82	1250	35.35											
4 5 0	2 8 1	1 6 12	0 8 9		16.12	3.90	1300	36											
4 7 8	2 9 8	1 7 8	0 8 13		16.48	3.96	1350	36.74											
4 10 0	2 10 15	1 8 4	0 9 0		16.72	4.03	1400	37.42											
4 12 8	2 12 6	1 9 0			17.00	4.12	1450	38.08											
4 15 0	2 13 13	1 9 12			17.28	4.28	1500	38.73											
5 1 8	2 15 4	1 10 10			17.56	4.28	1550	39.37											
5 4 0	3 0 11	1 11 8			17.80	4.32	1600	40											
5 6 8	3 2 2	1 12 11			18.12	4.39	1650	40.62											
5 9 0	3 3 9	1 13 10			18.48	4.45	1700	41.23											
5 11 8	3 5 0	1 14 10			18.59	4.53	1750	41.83											
5 14 0	3 6 7	2 0 0			18.72	4.62	1800	42.43											
6 12 0	3 9 5				19.03	4.75	1900	43.59											

TABLE

TABLE of the greatest ranges of sea-mortars, with different charges, deduced from actual experiments.

13 inch. chamber holds 3 lb.	Flight in seconds	Fuze in inches	Range in yards	10 inch. Chamber holds 12 lb.	Flight in seconds	Fuze in inches	Range in yards
10	15	5.18	3127	4	22½	4.83	2550
15	19½	5.83	3206	6	23	4.95	2650
20	25	6.25	3300	8	23½	5.75	2800
25	26½	6.74	3413	9	24½	5.94	3000
28	27½	7.03	3796	10	25	6.13	3200
30	29	7.25	4000	11	25½	6.25	3350
30	29½	7.25	4013	12	26	6.44	3500

Though these two last tables of all the different kinds of mortar-practice, deduced from actual experiments, are not strictly to be depended on by the practitioner, who has time and opportunity to make a set of experiments with the very piece he is using, (for those are preferable to any others); nevertheless, these two tables will be of singular use to a young officer who enters on actual service, without having seen much practice.

TILE, } in *military building*, a sort of thin,
TYLE, } factitious, luminated brick, used on
the roofs of houses; or more properly a kind of
clayey earth, kneaded and moulded of a just
thickness, dried and burnt in a kiln, like a
brick, and used in the covering and paving of
different kinds of military and other buildings.
The best of brick earth should only be made
into tiles.

The tiles for all sorts of uses may now be
comprised under 7 heads, viz. 1. The *plain tile*,
for covering of houses, which is flat and thin.
2. The *plain tile*, for paving, which is also flat,
but thicker; and its size 9, 10, or 12 inches.
3. The *pan-tile*, which is also used for covering of
buildings, and is hollow, and crooked, or bent,
somewhat in the manner of an S. 4. The *Dutch
glazed pan-tile*. 5. The *English glazed pan-tile*.
6. The *gutter-tile*, which is made with a kind
of wings. And 7. The *hip or corner-tile*.

Plain Tiles, are best when they are firmest,
soundest, and strongest. Some are duskier,
and others ruddier, in colour. The dusky-
coloured are generally the strongest. These
tiles are not laid in mortar, but pointed only
in the inside.

Paving-Tiles, are made of a more sandy
earth than the common or *plain-tiles*: the ma-
terials for these last must be absolute clay, but
for the others a kind of loam is used. These
are made thicker and larger than the common
roof-tiles; and, when care has been taken in
the choice of the earth, and the management
of the fire, they are very regular and beautiful.

Pan-Tiles, when of the best kind, are made
of an earth not much unlike that of the *paving
tiles*, and often of the same; but the best sort

of all is a pale-coloured loam that is less sandy;
they have about the same degree of fire given
them in the baking, and they come out nearly
of the same colour. These tiles are laid in
mortar, because the roof being very flat, and
many of them warped in the burning, will
not cover the building so well, as that no water
can pass between them.

Dutch glazed Pan-Tiles, get the addition
of glazing in the fire. Many kinds of earthy
matter running into a glassy substance in great
heat, is a great advantage to them, preserving
them much longer than the common *pan-tiles*,
so that they are very well worth the additional
charge that attends the using of them.

English glazed Pan-Tiles, are in general not
so good as the Dutch ones under that denomi-
nation; but the process is nearly the same.

Dutch Tiles, for chimnies, are of a kind
very different from all the rest. They are made
of a whitish earth, glazed and painted with va-
rious figures, such as birds, flowers, or land-
scapes, in blue or purple colour; and some-
times quite white: they are about 6.5 inches
each way, and three quarters of an inch thick.
They are at present grown into neglect.

Gutter-Tiles, are made of the same earth as
the common *pan-tiles*, and only differ from
them in shape; but it is advisable, that parti-
cular care be taken in tempering and working
the earth for these, for none are more liable to
accidents. The edges of these tiles are turned
up at the larger ends for about 4 inches. They
are seldom used where lead is to be had.

Hip or Corner-Tiles, are at first made flat
like *pan-tiles* of a quadrangular figure, whose
two sides are right lines, and the ends arches
of

W A D

W A D

of circles; the upper end concave, and the lower convex; the latter being about 7 times as broad as the other: they are about 10.5 inches long; but, before they are burnt, are bent upon a mould in the form of a *ridge-tile*, having a hole at the narrow end, to nail them on the hip-corner of the roof,

Ridge-TILES, are used to cover the ridges of houses, and are made in the form of a semi-cylindrical surface, about 13 inches in length, and of the same thickness as *plain-tiles*: their breadth at the outside measures about 16 inches.

W

WADDING. See this word in the first Alphabet.

Experiments relative to the effects of WADDING.

The quantity of powder requisite to raise a shell, weighing 218 lb. clear of the mortar and bed, was found to be 4 oz. 2 dr. without any *wadding*; but with the help of a little *wadding*, rammed over the powder, 3 oz. and 1 dr. was sufficient. The powder requisite to raise a shell weighing 106 lb. clear of the mortar and bed,

was found to be 2 oz. 6 dr. without any *wadding*; but with *wadding*, properly rammed over the powder, 2 oz. was found to be sufficient.

To raise a shell of 16 lb. 4 dr. was sufficient without *wadding*, and only 3 dr. with *wadding*.

And to raise a shell of 8 lb. 2 dr. was enough without *wadding*, and 1½ dr. with *wadding*.

From the above experiments it may be observed, that the judicious ramming a little *wadding* over the powder, adds about 1-4th part of the whole effect.

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